AMERICAN DYESTUFF REPORTER

SAMPLE SWATCH QUARTERLY

"Circulated Everywhere Dyestuffs Are Used"

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Devoted to the practical application of dyestuffs in all industries; especially to textile chemistry—the science and practice of scouring, bleaching, dyeing and finishing.

NEW YORK, JANUARY 23, 1928

Monochromatic Light Filters for the Visible Spectrum

One Hundred and Forty-fourth Contribution from the Color and Farm Waste Division, Bureau of Chemistry and Soils, U. S. Department of Agriculture, Washington, D. C.

By WALTER C. HOLMES

LIGHT filters which will restrict the transmission of light within definite spectral limits, are sometimes required for scientific work. When the spectral range of transmission is relatively narrow such filters are usually termed monochromatic. The following formulae for a series of nine inexpensive monochromatic filters in the visible spectrum were developed for those who may desire to prepare their own filters:

Formula I

Naphthol Yellow S	0.0038%
Formyl Violet S4B	0.0075
Thiocarmine R	0.0075
Copper Sulphate	5.0000

Formula II

Erio Green B Supra	0.0550%
Tartrazine	0.0028
Copper Sulphate	5.0000

Formula III

Tartrazine	0.0078%
Thiocarmine R	0.0097
Copper Sulphate	5.0000

Formula IV

Tartrazine	0.0700%
Thiocarmine R	0.0125
Copper Sulphate	5.0000

Formula V

Tartrazine	0.0933%
Thiocarmine R	0.0070
Ponceau 3R	0.0023
Copper Sulphate	5.0000

Formula VI

Tartrazine	0.0435%
Thiocarmine R	0.0044
Ponceau 3R	0.0087
Copper Sulphate	4.3500

Formula VII

Tartrazine	0.0119%
Ponceau 3R	0.0238
Copper Sulphate	14.2500

Formula VIII

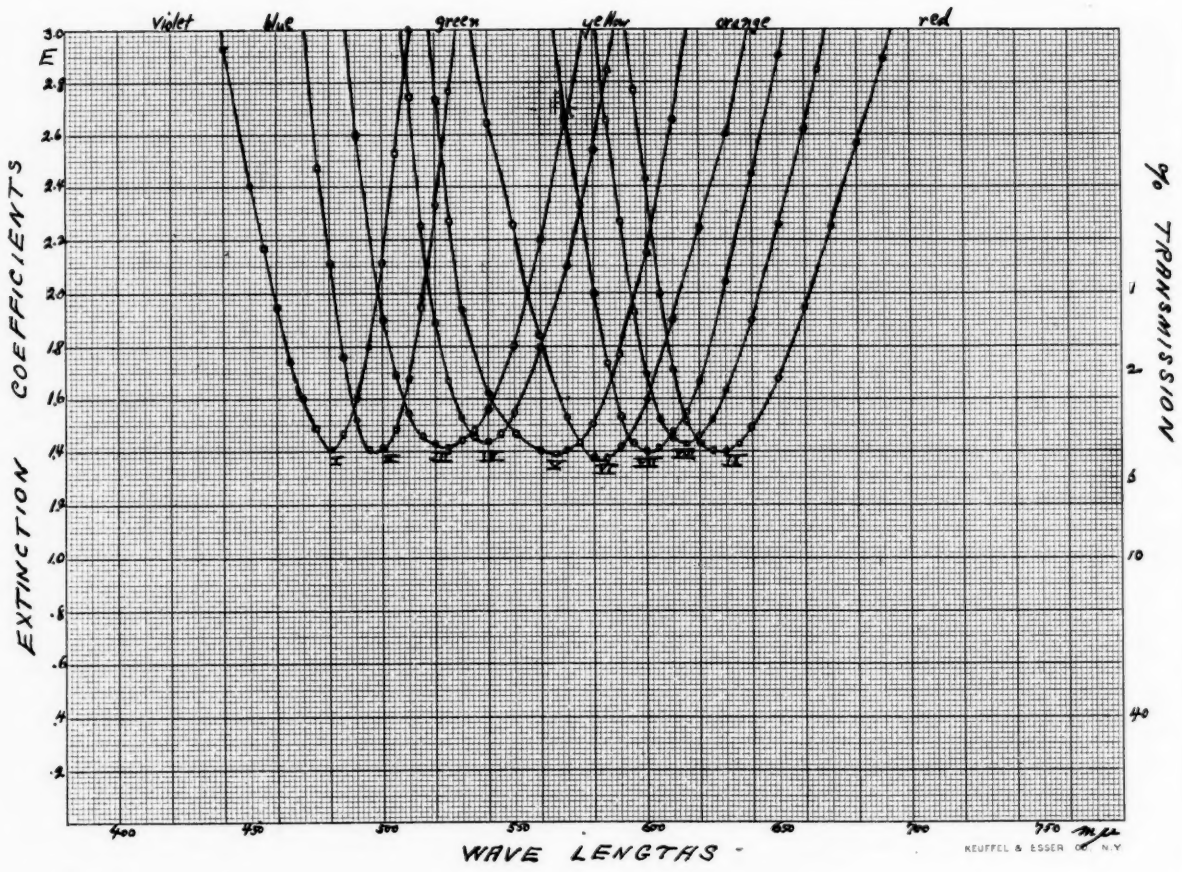
Ponceau 3R	0.0500%
Copper Sulphate	10.0000

Formula IX

Ponceau 3R	0.0900%
Copper Sulphate	6.7500

The percentages specified are concentrations in aqueous solution. The copper sulphate is specified in terms of the hydrated salt. The dye values recorded are the gross percentages of the particular dye samples employed in developing the formulae. The corresponding values for actual dye may be calculated from the following data: The Naphthol Yellow S contained 92.5 per cent actual dye; the Tartrazine, 92.5 per cent; the Ponceau 3R, 86.0 per cent; the Formyl Violet S4B, 37.0 per cent, and the Thiocarmine R, 56.8 per cent. The actual dye content of the Erio Green B Supra (Geigy) cannot be supplied owing to an uncertainty with respect to its precise constitution. The strength of the sample employed is defined adequately, however, by its titanous chloride consumption. A gram sample of the dye required 14.86 c.c. of 0.1 N $TiCl_3$ for reduction.

The solutions are intended for employment in 2-cm.



layers in glass containing cells. Their absorptions were measured in such cells by means of a Hilger wave length spectrometer equipped with a Nutting photometer. The light source was a 250-watt Mazda lamp. The measurements obtained are recorded in the accompanying graph.

Extinction coefficients (densities) are plotted against wave lengths (mμ). The extinction coefficient (E) is the common logarithm of the reciprocal of transparency. A value for E of 1 is equivalent to a light transmission of 10 per cent; a value of 2, to a transmission of 1 per cent; and a value of 3, to a transmission of 0.1 per cent.

A glance at the curves, accordingly, affords an adequate idea of the transmission of the various filters. With Formula IV, for example, it is evident that maximum transmission occurs at approximately 540 mμ and that the transmission at that wave length is approximately 4 per cent. With the same filter the limits of 1 per cent transmission are 518 and 567 mμ, and the limits of 0.1 per cent transmission are 508 and 588 mμ. Outside the latter range the transmission of light in the visible spectrum is negligible.

Each filter was designed to afford a maximum light transmission of approximately 4 per cent. In any instance, however, the maximum transmission may be altered at will by means of simple manipulations. If, for example, the solutions are employed in 1-cm. instead of 2-cm. layers, or if the 2-cm. layer is employed and the concentrations of the absorbing substances in the solution are halved, the extinction co-efficients of the filter will also be halved, and the maximum transmission will increase to approximately 20 per cent. The degree to which the filters must be modified by such means in order to obtain any desired approximate maximum transmission may be calculated readily.

The wave length of maximum transmission of any filter is unaffected by such modifications, but the quality of the transmitted light is somewhat altered. When maximum transmission is increased the spectral range within which appreciable transmission occurs is proportionately increased. Increased transmission, in other words, will be attended by a decrease in the relative homogeneity of the light.

A process for purification of caustic soda from the soda solutions used in rayon manufacture is reported to be in successful operation at several Italian plants, and its application will be extended to others, according to a report from Assistant Trade Commissioner E. Humes of Rome. A description of the progress, which was developed by Dr. Leonardo Cereni, of Milan, is available to interested American firms.

CHINA'S DYE IMPORTS HAVE DECLINED

Germans Hold Large Share of Trade

(From Special Correspondent)

According to a recently-issued report by the American and European managed Chinese Maritime Customs service, the total importation of dyes and pigments into Shanghai during the past year decreased considerably, although arrivals of dried artificial Indigo increased 200 per cent. This report by the customs service, while resembling similar publications of some European countries in its appearing some months after the close of the period, is considered the most authentic one issued, and it is closely read and watched by business men interested in the Far Eastern trade.

It points out that of these classifications, artificial Indigo was the outstanding item. Total importations of liquid and paste amounted to 289,713 piculs (a picul is 133 1-3 pounds), a falling off of 92,649 piculs, or Hk. Tls 3,931,000 (the tael had an average value of U. S. 76 cents) in value, when compared with the figures for 1925. Dried artificial Indigo had a total of 21,845 piculs.

"The falling off," it says, "may be attributed in part to the considerable stocks carried over from the previous year, which were reduced to a more normal size by the end of December. Prices fell still further during the period, the drop ranging from Hk. Tls. 5 in the case of 20 per cent Indigo to about Hk. Tls. 15 for 60 per cent. German quotations remained somewhat higher than those of other countries; but in spite of this fact the following table shows that Germany's share of the total trade continued practically the same:

	1925 Percentage	1926 Percentage
Germany	62.8	61.4
United States of America	21.9	23.5
Switzerland	6.8	8.1
France	3.5	3.8
Other countries	5.0	3.2

"America's share of the total importations of 20 per cent Indigo rose from 29 to 42 per cent, while Germany made a rapid advance in the higher percentage dyes."

The customs report for all of China says of aniline dyes, however, that, "Despite all the difficulties arising from civil war, brigandage, and violent fluctuations in Chinese currency, the importation of aniline dyes during 1926 remained about the same as in 1925. Not having dye factories of her own, China is dependent on foreign dyes; therefore, so soon as conditions permit, the demand for dyestuffs comes forward briskly from all parts of the country. If the 1926 results were not profitable for dealers, the causes are to be found in the all-too-frequent interruptions of communications with interior markets and in a policy of price-cutting between the different firms.

"A feature of the aniline dye trade during the year was the liquidation of the less popular 'chops,' or brands, of Sulphur Black stocks by the syndicate of German firms in China, with the intention of concentrating in future on the best known and more popular qualities. Aniline dyes to a total value of Hk. Tls. 3,478,148 were imported during 1926 into all of China, as against Hk. Tls. 3,593,631 in 1925 and Hk. Tls. 10,610,427 in 1924. The bulk of the trade, some 70 per cent, was derived from Germany, while 20 per cent came from America, and the remaining 10 per cent was shared between Switzerland, England and France.

"The price of artificial Indigo showed symptoms of declining in the earlier part of the year and was far from satisfactory. The drop in silver exchange brought about a slight reaction, and towards the end of 1926 prices remained steady at the not very remunerative level of Tls. 33 to Tls. 35 for old German and Swiss 'chops,' while new 'chops' from America, England and France were some 10 per cent cheaper.

"There was keen competition between German and American Indigo, although the German article was somewhat on the decline, while imports from England were at one time suspended on account of the coal strike in that country. Sales of English Indigo during the year were greatly in excess of imports, resulting in a depletion of stocks. The total amount of artificial Indigo imported during 1926 was 317,481 piculs, as compared with 406,537 piculs in 1925 and 416,285 in 1924, and of the total importation, 97,460 piculs came from Germany."

AMALGAMATION OF ITALIAN DYE FIRMS

The outstanding event of the year in the Italian chemical industry, according to a report from the Department of Commerce, Chemical Division, was an agreement made between the S. I. P. E. Cengio and the Italica, manufacturers of intermediates and dyes, for the interchange of raw materials, by-products, etc. This pact also called for centralized buying and selling. The cooperating firms, together with the Schiapparelli, are controlled by the Societie Italiana de Gas of Turin.

The capital of the Fabbriche Italiane Materie Coloranti Benelli, it was decided at a recent meeting of the company's board of directors, will not be increased. The fiscal year 1926-1927 closed with a loss of over six million lire, which is attributed to the heavy amortization made during the year.

ACETATE SILK DYEING PROCESS PATENTED

An improved process for the application of basic dyes to acetate rayon has been developed and patented by the German dye trust. The importance of the invention is said to depend on the fact that it increases the number of dyes that can be applied to that type of rayon.

German Patent No. 439,004, dated May 2, 1923, protects a process governing the dyeing of acetate rayon with basic dyestuffs with the aid of Pyridine. A new patent

has been issued additional to No. 439,004, dated June 23, 1927.

In accordance with this patent, it has been further discovered that instead of Pyridine, its hydration products, such as piperidine, can be used with equal success and at considerably lower expense.

CHEMICAL EXECUTIVES TO MEET IN WASHINGTON

A general meeting of executives of the American chemical industry will be held in Washington on February 16, at which members of the United States Department of Commerce will report on and discuss activities in the leading chemical centers of Europe.

The program of this meeting has been arranged by co-operation between the Chemical Advisory Committee and the Bureau of Foreign and Domestic Commerce. The most significant aspects of the European chemical situation will form the principal topics of discussion. Assistant Commercial Attache Reagan of Paris and Trade Commissioner William T. Daugherty of Berlin have been recalled from their posts for the purpose of contributing their specialized knowledge of conditions to the symposium.

Chemical trusts and cartels will be discussed by William J. Donovan of the Department of Justice, who will also talk on recent developments in European international consolidations in the chemical field. The principal features of the business situation in both the domestic and foreign chemical trade will be outlined and commented upon by Dr. Julius Klein, director of the Bureau of Foreign and Domestic Commerce. Other members of the commerce department who will speak to the chemical executives will include C. C. Concannon, chief of the Chemical Division; Ray M. Hudson, assistant director of the Bureau of Standards, engaged in waste elimination work, and T. W. Delahanty, assistant chief of the Chemical Division.

During the course of the meeting an Open Forum will be conducted, at which questions of those attending will be answered by various division and bureau heads connected with the department, thus giving the chemical men an opportunity to learn of the many facilities for service offered by the department and to discuss thoroughly such practical matters as trade disputes, foreign credits and tariffs, trade statistics, etc.

At the banquet which will close the meeting Secretary Hoover will be the guest of honor and principal speaker.

The Du Pont Cellophane Company have moved their main sales offices from 40 West Fortieth Street, New York City, to the new Park Avenue Building, located at Thirty-second Street and Fourth Avenue. The new larger quarters which the company is taking at this time are necessary due to the expansion in the use of Cellophane during the past three years. It is now being used as a wrap in over thirty industries.

SILK INDUSTRY WELL REPRESENTED AT ANNUAL DINNER

More than a thousand members of the American silk industry and their guests attended the fifty-sixth annual dinner of the Silk Association of America held last Thursday evening, January 19, in the grand ballroom of the Hotel Astor, New York.

Those at the dinner represented silk firms located all over the United States and in many foreign countries. Numerous Government officials and members of foreign consulates in the silk producing centers of Europe and the Orient were present.

Robert J. F. Schwarzenbach, vice-president of the association, welcomed members and their guests in the opening address. Invocation was pronounced by Rev. W. Warren Giles, rector of the First Reformed Church of Orange, N. J. The chief speaker, Hon. Frank B. Willis, United States Senator from Ohio, was unable to attend. Other speakers were: Samuel W. Reyburn, president of the Lord & Taylor Company; Donald Ogden Stewart and Beverly Nichols, both well-known authors and humorists. Music during the dinner hour was furnished by Paul Whiteman's Piccadilly Players.

The dinner committee included E. Irving Hanson, chairman, Paul Hyde Bonner, James A. Goldsmith, H. Morton Merriman and H. F. Scudamore.

Officers of the association are as follows: President, H. Schniewind, Jr.; vice-presidents, Emil J. Stehli, Robert J. F. Schwarzenbach, Albert Forsch; secretary and treasurer, Ramsay Peugnet; member of the executive committee, H. M. Merriman.

PHENOL REPORT ISSUED

The United States Tariff Commission has issued in printed form its report to the President upon an investigation of the costs of production and other competitive factors in the production of phenol in the United States and in Great Britain. The investigation was conducted for the purpose of assisting the President in determining whether or not the existing rate of duty properly equalized the domestic and foreign costs of production.

The principal uses of phenol are in the manufacture of synthetic resins and plastics, including bakelite, and in its transparent form in the production of imitation beads, toilet articles and cigarette holders. Phenol is also used in the manufacture of disinfectants and antiseptics, which is the old familiar use of carbolic acid. During the war great quantities were produced for the manufacture of picric acid and other high explosives. Production for this purpose was about ten times the normal peace-time requirements for phenol. Other important uses of phenol are in the preparation of intermediates for coal-tar dyes and pharmaceuticals.

Phenol is made in the United States by two processes, the natural and the synthetic. Production by the so-called natural method results from the distillation of coal tar. During the war large quantities of phenol were produced

synthetically from benzene, the by-product of coke ovens. Beginning in 1923, the synthetic process was revived following the greatly increased demand for phenol for the manufacture of synthetic resins, and by the end of 1926 the synthetic process was supplying from 80 to 90 per cent of the total consumption.

Copies of the report, as issued, may be obtained upon request addressed to the United States Tariff Commission at Washington, D. C.

FOUR NEW COLORS ON DU PONT LIST

The Dyestuff Division of E. I. du Pont de Nemours & Co. recently announced the production of four new dyes, the additions being divided among several of their brands. These colors are: Du Pont Naphthanil Scarlet for printing, Sulfranthrene Red 3B Paste, Ponsol Yellow AR Double Paste and Pontamine Fast Heliotrope BL.

The Naphthanil Scarlet, of particular interest to printers of cotton fabrics, is described as similar in working properties to the Du Pont Naphthanil Red. The new scarlet, it is claimed, makes it possible to produce reds and pinks of extremely good fastness to light, washing, crocking and chlorine. The use of this color, it is further mentioned in the announcement, renders unnecessary the preparation of goods and subsequent coupling in printing.

Sulfanthrene Red 3B Paste, a vat color which produces reddish shades of violet, is described as reducing easily and completely at 140 deg. Fahr., and as requiring but a small amount of alkali, a feature recommending its use on silk and rayon. It can be used in all types of circulating machines for printing, also jigging, and for all types of material, where exceptional fastness is required, except in draperies calling for a high degree of light fastness. It is suitable for printing but not for discharging.

Ponsol Yellow AR Double Paste is an addition to the Du Pont range of cold dyeing vat colors, and is described as giving clear golden yellow shades possessing very good fastness to water, washing, acids, perspiration, chlorine, etc., and good light fastness. It is said to reduce easily, oxidize readily and dye exceptionally level, which permits additions of the color to the bath before the material has been entered. This color is not suitable for printing or discharge work.

The new Pontamine Heliotrope is, according to the description, a direct color very fast to light that does not change on the drying cans and produces brilliant reddish shades. Its fastness to acetic acid, ironing, alkali, mercerizing, and, in light shades, to washing, is claimed to be good. It is a color useful not only on cotton but also on silk and rayon, giving on silk a royal purple. On rayon underwear it is said to be especially suitable for delicate shades.

Cheney Brothers, silk manufacturers, despite a 10 per cent wage cut affecting 3,000 employees, will continue to maintain present production and quality bonuses for individual ability. Competition was blamed by officials as the cause of the wage reductions.

BRADFORD DYERS RAISE RATES

A revision of prices for dyeing and finishing certain types of fabrics has been announced by the Bradford Dyers' Association of Bradford, England, where practically all textiles are processed on a commission basis. The dyeing trades of this section constitute an industry separate from the mills.

The new rates affect the dyeing of wool dress goods, costume cloths, cross dye gabardines and goods containing rayon, which advances the charges for lightweight fabrics and prescribes higher rates for single piece dyeings, in the hope of increasing the number of pieces dyed in any one shade. A change has been made also in calculating work on a yardage instead of a poundage basis

During the past few years, according to Consul A. R. Thompson, of Bradford, the tendency of the trade has been toward a variety of color so that the number of pieces dyed any particular shade has decreased, which has raised the dyers' costs per piece.

LIST OF APPRAISEMENTS OF COAL-TAR PRODUCTS WITHIN PARAGRAPHS 27 AND 28 OF THE TARIFF ACT OF 1922

The following list of imports contains the month of entry, the name of the product within paragraphs 27 and 28, together with the designations as "C" (for competitive) and "NC" (for non-competitive), which indicates the appraisement basis for the assessment of the ad valorem duty in paragraphs 27 and 28 of the Tariff Act of 1922.

The ad valorem rate for competitive dyes is based on the American selling price, as defined in Subdivision (f) of Section 402 of Title IV; the ad valorem rate for non-competitive dyes is based on the United States value, as defined in Subdivision (d) of Section 402 of Title IV of the Tariff Act of 1922.

This list contains the appraisements received since the publication of the October list for the Port of New York, beginning with January, 1927.

JANUARY

Basic Pure Blue BC Powder	NC
Benzo Fast Black L Powder	C
Thio Indone Scarlet BB Paste	NC
Vat Brilliant Blue R Paste	C
Vat Scarlet 3B Powder	NC

FEBRUARY

Acid Milling Black B 652 50%	C
Anthra Yellow GC Paste	NC
Anthra Yellow GC Powder	NC
Brilliant Phosphine 5G 88%	C
Chlorantine Fast Blue 2GL 36%	C
Chlorantine Fast Yellow 4GL 79%	C
Ciba Pink B Paste 20%	NC
Ciba Pink BG Powder 68%	C
Ciba Red R Paste 20%	NC
Ciba Yellow G Paste 10%	NC
Cibanone Green GG Powder 54%	NC
Cloth Fast Orange G 68%	NC
Diazophenyl Black V 360 55%	C
Diphenyl Brown BBNC 132 80%	C
Diphenyl Fast Brown GNC 129 55%	NC
Erio Fast Brilliant Violet BR Supra 778 75%	NC
Eriochrome Blue S 955 60%	NC

Eriochrome Flavine A Conc. 1015 45%..... C
Ethyl Violet 79% ..... NC
Kiton Fast Green V 50%..... C
Lanasol Blue R 90%..... NC
Novazol Violet B 769 85%..... NC
Novazol Blue B 966 63%..... NC
Polar Red G Conc. 596 70%..... NC
Polar Red R Conc. 597 65%..... NC
Setoglaucine Conc. 413 85%..... NC
Vat Pink BN Paste..... NC
Vat Violet 2B Paste..... NC

MARCH

Ethyl Violet 79%..... NC
Rhodamine Scarlet G Powder..... NC
Vat Scarlet 3B Powder..... NC

APRIL

Direct Light Blue 8G..... NC
Fast Cotton Brown 4RL 90%..... NC
Malta Gray J..... NC
Neutral Gray G 44%..... NC
Violet Red RH..... NC

MAY

Acid Alizarine Black R..... NC
Brilliant Wool Blue FFR Extra..... NC
Chlorantine Fast Blue 2GL 36%..... C
Chlorantine Fast Brown BRL 72%..... NC
Chlorantine Fast Yellow 4GL 79%..... C
Cibanone Blue G Paste 20%..... C
Cibanone Red B Powder 75%..... NC
Diazo Fast Blue 2BW 36%..... NC
Direct Safranine RW 99%..... C
Ethyl Violet 79%..... NC
Grelanone Brown RR Powder..... NC
Neolan Bordeaux R 75%..... NC
Neolan Violet Brown B 80%..... NC
Pyrogene Cutch 2R Extra 61%..... NC
Rosanthrene 3BN 32%..... NC
Rosanthrene Bordeaux B 73.5%..... NC
Wool Blue 5B/50 free from salt 100%..... NC

JUNE

Alizarine Red SW 72%..... C
Anthra Red RT Powder..... NC
Benzyl Fast Blue 3GL 34%..... NC
Blue FF Powder..... NC
Brilliant Sky Blue 8G Extra Powder..... NC
Chloramine Brilliant Red 8B Conc..... NC
Chlorantine Fast Blue 4GL 75%..... C
Chlorantine Fast Green B 82%..... NC
Chlorantine Fast Gray B 98%..... NC
Chlorantine Fast Violet 5BL 30%..... NC
Ciba Pink BG Paste 20%..... C
Cibanone Black B Powder 72%..... NC
Cibanone Orange 6R Paste 20%..... C
Cibanone Red G Powder 85%..... NC
Cloth Fast Brown 5R 33%..... NC
Cloth Fast Yellow G 40%..... C
Ethyl Violet 79%..... NC
Fast Cotton Gray VL 85%..... NC
Fluorescent Blue ..... NC
Grelanone Brown RR Paste..... NC
Indigosol Pink HR Extra..... NC
Kiton Fast Red R 50%..... C
Kiton Fast Yellow 3G 81%..... C
Methyl Violet 300 XE Extra Conc..... NC
Neolan Violet Brown B 80%..... NC
Neolan Yellow R 42%..... NC
Pyrazol Orange G Conc C
Pyrogene Blue Green B 57%..... NC
Pyrogene Pure Blue 3GL 20%..... NC
Ultra Cyanol B Conc..... NC
Xylene Fast Green B Conc..... C

JULY

Brilliant Wool Blue FFR Extra..... NC
Chloramine Brilliant Red 8B Conc. 100%..... NC
Chloramine Light Violet R 100%..... NC
Chloramine Red B..... C
Chlorantine Fast Red 5BL 36%..... C
Ciba Brown G Paste 20%..... NC
Cibanone Red 4B Paste 20% Paste Pat..... NC
Cloth Fast Orange G 68%..... NC
Diazol Light Red N8R..... C
Fluorescent Blue 10%..... NC
Indochromine RR Conc. 100%..... NC
Malta Gray J..... NC
Methylene Green G Extra 79%..... C
Omega Chrome Brown EB 70%.. C
Vat Gray 6B Powder 70%..... NC

AUGUST

Benzo Dark Brown Extra 100%..... C
Chloramine Fast Orange G Conc..... C
Chlorantine Red 3B..... C
Chlorantine Fast Green B 82%..... NC
Chlorantine Fast Violet RL 36%..... NC
Cloth Fast Brown 5R 33%..... NC
Diazamine Blue BR Conc..... NC
Diazo Black VG 40%..... C
Ethyl Violet 79%..... NC
Indanthrene Black BB Powder..... C
Lanasol Blue R 90%..... NC
Neolan Black 2G 45%..... NC
Neolan Orange R 72%..... NC
Neolan Yellow R 28%..... NC
New Blue RS..... C
Pyrazol Orange G Conc. 90%..... C
Vat Blue GCD Double Paste..... C
Vat Brown R Paste 12½%..... NC
Vatamine Scarlet 2B Powder..... C
Viridine Lake Powder 30%..... C
Xylene Blue AS Conc..... C
Xylene Blue VS Conc..... C
Xylene Light Yellow 2G..... C
Xylene Milling Orange R Conc..... NC

SEPTEMBER

Acid Milling Yellow G Conc..... NC
Alizarine Light Blue B..... C
Alizarine Red SZ..... C
Alkali Blue R..... C
Brilliant Sulphon Red B..... C
Chloramine Brilliant Red 8B Conc..... NC
Chloramine Red 3B..... C
Diazamine Blue BR Conc..... NC
Diazol Light Red N8B 56%..... C
Madder Lake Powder..... C
Madder Lake VN14 Powder..... C
New Methylene Blue NS Conc..... NC
Rhodamine 6GH Extra..... C
Trisulphon Brown B Conc..... C
Viridine Lake Powder H 1026..... C
Xylene Blue VS Conc..... C
Xylene Brilliant Blue FFRX Conc..... NC
Xylene Fast Green B Conc..... C

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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SEVENTH ANNUAL MEETING

SATURDAY AFTERNOON SESSION

December 3, 1927

The meeting convened at 2.20, Dr. E. H. Killheffer, President of the Association, presiding.

President Killheffer—Our first paper this afternoon will be, "The Ever-Changing Textile Problems of the Dry-Cleaner," by Lloyd E. Jackson.

Mr. Jackson! (Applause.)

. . . Mr. Jackson presented his prepared paper:

The Ever-Changing Textile Problems of the Dry-Cleaner

By LLOYD E. JACKSON*

Many textile materials are designed to withstand wear and repeated washing or laundering. The cloth is made durable and the dyes are chosen to be fast to washing, light, perspiration, etc. The consumer of such fabrics selects them for the purpose which they are to serve, primarily because of the properties that conduce to long life. Other textile fabrics are designed more for beauty and their lasting qualities are a secondary consideration. To be sure, beauty and lasting properties may be and have been combined; nevertheless there are sheer fabrics and laces produced which have very little durability.

Textiles in service become soiled sooner or later. In some sections, such as smoky industrial centers, they must be renovated soon after the first and every other time they are used. In practically every case the consumer of textiles expects to have them renovated one or more times.

The common methods for restoring soiled textiles to usefulness are washing in water or in petroleum naphtha and other so-called dry solvents. Many materials can be properly cleaned only with soap and water, while others can be effectively cleaned only with the dry solvents. Dry-cleaning is the mildest method of renovating known. Consequently the most delicate and least durable fabrics are submitted to the dry-cleaner.

The dry-cleaner classifies the work sent to him according to the method of cleaning he must employ

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to renovate it. The more durable materials such as are found in woolen suits, heavy draperies, etc., may be cleaned by machine methods. The more delicate materials must be cleaned by hand. For the most part, articles submitted for dry-cleaning are garments and house furnishings made of silk, wool and rayon. The latter textile is being encountered in increasing quantities within the last few years.

Defects in Design of Fabrics

The design of the various articles submitted and the textiles used in them change from year to year. This is particularly true of wearing apparel, especially ladies' garments. Although the greatest care is exercised in cleaning ladies' garments, the dry-cleaner experiences more trouble with that class of work than with any other. The reasons for these difficulties are the design of the garments, the natural wear that occurs in use, and, greatest of all, the characteristics of the textile fabrics employed to make them. New types of fabrics are being produced continually, the characteristics and cleanability of which the dry-cleaner has no knowledge of. Difficulties are encountered in other classes of work because of textile defects, but to a less extent. Often new fabrics have some characteristic which makes it impossible to renovate the article made of them without destroying its usefulness. It is the new fabrics, improperly designed for renovating, which cause the ever-changing textile problems of the dry-cleaner. The dry-cleaner must always be on the alert for articles containing fabrics which he knows from experience will be troublesome or which have not been encountered before. In the latter case he cleans them by methods which have been found suitable for the most similar materials. If the fabric happens to be a troublesome one, one or more articles made of it may be ruined before a successful method for renovating is discovered. In some cases the chances for successfully cleaning the fabric are so small that the article is returned to the owner without cleaning or else it is cleaned at the owner's risk.

The outstanding difficulties encountered are shrinkage, water marks, slipping, fugitive colors, and lately the solvent action of cleaning and spotting agents on fabrics containing acetate rayon. Cloth containing acetate rayon is being produced which cannot be distinguished from silk by ordinary observation.

Shrinkage is a dry-cleaning problem which has become more prevalent in the last few years. It is most troublesome in silk crepes. When speaking of shrinkage during dry-cleaning, reference is made to the entire process of renovating, which includes washing in petroleum naphtha or other so-called dry solvents and finishing by steaming and pressing. When shrinkage does occur during the process it usually happens in the finishing. Sometimes, however, shrinkage occurs during washing and before the finishing part of the process. Some silk crepes shrink during the dry-cleaning process and others do not. Even crepes of the same general type are not uniform in this respect. For example, some georgette crepe is unchanged by dry-cleaning, while other georgette crepe may shrink several inches per yard under the same conditions. Non-uniformity makes the problem more difficult because the dry-cleaner cannot be sure before he starts a job whether or not it can be done without shrinking. The examination of troublesome crepes indicates that the cause of shrinking is too much twist on thread used for weaving the fabric.

Another class of material which recently has been submitted to the dry-cleaner is known as shadow velvet, or transparent velvet. It is an exceedingly beautiful and attractive piece of material, but it shrinks when it is steamed. Articles made of the fabric must be steamed during the finishing process to remove wrinkles and to raise the pile. The shrinkage of two grades of the cloth was determined by measuring pieces before and after steaming. In both cases a shrinkage of 4.0 per cent in the way of the warp thread was obtained.

Right here I might say that as I understand it, a tolerance of 5 per cent for shrinking is allowable in fabrics. We found that this particular cloth shrinks 4 per cent. That comes within the tolerance. But it isn't satisfactory from the consumer's point of view, because the material is used in tight-fitting dresses, and a dress that will shrink 4 per cent becomes so tight that the wearer can't get into it. So it isn't a practical thing to allow a tolerance of 5 per cent.

Shrinkage also occurs during the dry-cleaning process in loosely constructed wool coating materials which are used for ladies' coats.

Water-Marks Caused by Starch

The wearer often spills water or liquids containing water on a garment. If the material from which the garment is made is of the type that is marked by the liquid a spot remains after the cloth is dry. The dry-cleaner then has another problem with which to contend. The shadow velvet mentioned is particularly troublesome in this respect. Most silk crepes water-mark readily. Water-marks are difficult if not impossible to remove by dry-cleaning methods. A number of the most troublesome types of silk fabrics were examined to determine the nature of the finishing materials used in them. It was found that the cloth most

easily water-marked and from which the marks were most difficult to remove contained starch. Silk fabrics which do not water-mark readily were found to contain no finishing compounds.

Customers of dry-cleaning plants complain that coats made of a certain type of Bolivia cloth do not water-mark easily until after they have been dry-cleaned. Apparently the cloth has been treated with a finishing material which is soluble in petroleum naphtha, and it is washed out during dry-cleaning. Although the water-marks in Bolivia cloth, velvets, etc., usually can be removed by steaming, they are a source of considerable annoyance to the consumers of these materials, and no doubt much more of the materials would be used if they would not water-mark so readily. If finishing materials must be used in fabrics, the most satisfactory type of material from the consumer's and dry-cleaner's point of view would be one that is insoluble in both water and petroleum naphtha.

Slipping presents a problem for which the dry-cleaner must always be on the outlook. Two particularly troublesome types of fabrics that are submitted for dry-cleaning are some of the loosely woven rayon drapery materials and printed georgette crepe.

Because rayon is a smooth fiber, fabrics made of it slip easily unless the weave is such that the threads are held firmly in place. If the weave is plain, it must be close or else the threads will slip so readily that it is practically impossible to renovate the fabric. If the weave is the open type which is usual in drapery materials, the warp threads should be twisted or crossed between the filling threads or group of filling threads in such a manner that all of the threads, warp and filling are held firmly in place. There are a number of rayon drapery materials of the latter type which can be dry-cleaned successfully.

Fugitive Colors

When the threads in printed georgette crepe slip to a degree that would not be noticeable in a fabric of plain color, the colored threads in the design shift into the white or base color of the cloth to produce an appearance which would be obtained if the printed color had been fugitive and had bled into the base color. Articles made of this type of cloth have been submitted for dry-cleaning which had to be returned to the owner without being dry-cleaned because to have cleaned them would have produced an unsightly job.

Fugitive colors are found in silk dress goods more than in other materials handled by the dry-cleaner. The colors are so fugitive in many cases that food spots, etc., cannot be removed from the dresses without removing some of the color. The colors used in some changeable silks, produced by weaving threads of different colors, are so fugitive that water spilled on the cloth or spotting agents used to clean them cause the different colors to blend to obtain an effect which it is impossible to remedy. The best that can be done under such conditions is to redye the garment one color and that is not always feasible.

Acetate rayon is a textile material which can be renovated quite successfully by dry-cleaning methods. Acetate rayon is soluble in many of the organic solvents which are used in dry-cleaning plants to remove spots from silk and wool materials, and hence the dry-cleaner must avoid using any of these spotting agents on acetate rayon. The problem of the dry-cleaner is to distinguish fabrics containing acetate rayon from genuine silk. The fiber is being combined with genuine silk and worked into cloth that cannot be distinguished from pure silk fabrics, and it is not uncommon for a dry-cleaner to discover after the damage has been done that the spotting agent he has been using on a supposedly silk article has dissolved the acetate rayon which he did not know it contained. Some of the solvents that dissolve acetate rayon are so effective for spotting silk that considerable hardship for the dry-cleaner would result if he discontinued using them on silks. It would be helpful to the dry-cleaner if some method for quickly distinguishing materials containing acetate rayon could be devised.

The main textile difficulties of the dry-cleaner have been mentioned. If they could be eliminated, say by means of tests of fabrics to determine if they can be renovated or not, before the fabrics are produced and sold in quantities, it would be beneficial to all concerned with textiles, and that includes everyone in the civilized world. The ultimate consumer would be better satisfied with more serviceable textiles. The merchant who sells them would have less loss from frozen stocks and less adjusting to do. The manufacturer would avoid the expense of placing fabrics on the market which do not go over good because of defects which are not apparent until articles made of them need renovating, which might be months after production and sale of the first products. He would not be confronted with the receiving indications of large first sales which would drop abruptly when it is discovered that the materials cannot be successfully renovated. Lastly, the dry-cleaner could give more efficient service to satisfied customers.

In designing and producing textiles too much serviceability should not be sacrificed for beauty in the product. It is not reasonable that consumers of textiles should expect them to stand renovation, at least by the mildest method, which is dry-cleaning, properly done.

I have here some samples of the cloth that I mentioned. Here is a piece of shadow velvet which you can see is a very beautiful piece of cloth. That is one of the pieces that shrinks 4 per cent on steaming.

Here is another piece of some kind of material. It is a little different quality. This one is a silk. This one is a silk back with a rayon pile.

Here is a piece of Canton crepe that to ordinary observation can't be distinguished from silk. It contains a filling of acetate rayon.

Here is another piece of very fine silk. You can see that it is a sheer fabric. It contains acetate rayon.

Here is a piece that is all acetate rayon. It is a little thicker.

Until recently the dry-cleaner could distinguish the acetate rayon from the silk articles by the fact that the acetate rayon materials were a little bit thicker, a little heavier, and he became suspicious of any heavy materials that looked like they might be acetate rayon. He could easily make a test on a thread with a little acetone, and tell whether it was acetate rayon. But if he were to test every silk or silk-like article that came into the plant, to determine whether it contained rayon or not, it would be an endless job if he had to do it by means of acetone tests.

Here is a piece of taffeta made of acetate rayon.

Here is a piece of printed georgette. That dot is printed in there, and the least little shift makes it look as though that color had run into the white base. If the same amount of shifting took place on a piece of white or blue fabric, it wouldn't be noticeable.

Here is another piece of acetate rayon material.

Here is a type of cloth, a changeable silk, that causes trouble in marking. If a water-mark gets on it or if food material is spilt on it, it causes the colors to blend.

Here is a type of lace that causes trouble in dry-cleaning plants. It is used for trimming. It is an expensive silk lace. It is almost impossible to renovate that type of material. It tears and goes all to pieces in the mildest treatment that we can give it.

I thank you. (Applause.)

Discussion of the Dry-Cleaner's Problems

President Killheffer—Some of the points raised by the speaker should be provocative of further comment, I should think, from some of the textile people in the audience. We should be glad to hear from anyone.

W. S. Williams—I understand Mr. Jackson to say that he has come to the conclusion that water spots were caused by starch and that pure-finished goods without starch did not spot.

Mr. Jackson—That is one cause of spots. We examined, as I said, a number of pieces of silk that we obtained on the market, to determine the finishing materials that had been used in them, and the type of material that we had the most trouble with in the plant contained starch.

Mr. Williams—In the first place, I doubt if they would use starch for that kind of material. If it were starch, it would be insoluble, and I can see no reason why you get any water spots from it. If it were soluble gum, the condition would be entirely different.

Mr. Jackson—We got quite a positive test for starch. Apparently it was there, and it does water-mark. I can assure you of those facts.

These are types of water-marks that will come out when the goods are immersed in water. But that is not a practical thing to do in many cases. For instance, a garment comes into the plant. It is pleated, or it may be constructed in such a way that to wet it in water would ruin it. We must use dry-cleaning methods in order to clean or renovate that garment, and if it is full of water-marks, it may be impossible to renovate it.

Mr. Williams—I should imagine in that case you had a soluble starch which was still in condition to give a starch test that was soluble in water.

Mr. Jackson—It is apparently soluble in water, or it forms a colloidal solution in such a way that it is carried to the outside of the wet area on the cloth to form a ring.

President Killheffer—Are there any further points to be considered in connection with this paper?

Dr. H. C. Chapin—Has your Association formulated any set of tests which might be applied by a manufacturer to his goods to see whether these goods are satisfactory for dry-cleaning?

Mr. Jackson—No, we haven't, for the very good reason that has been brought out in this meeting: that no entirely satisfactory method of comparing washing methods in the laboratory and in the plant has been devised.

The best way, and the way we would recommend tests of that kind to be carried out, would be to submit a sample piece to a recognized dry-cleaner, and let him put it through the regular process. If you took only a small piece, it might be that the same conditions would not exist in the mill, where large pieces are handled, because in dry-cleaning plants many of the articles that are submitted for cleaning are small. Say we could take a square yard of material and determine under the very conditions that exist in practice what would happen to that material when dry-cleaned. From one standpoint, you might say we don't need a laboratory method, if the manufacturer will submit it to some recognized dry-cleaner—and there are recognized dry-cleaners all over the country.

M. H. Goldman—I want to say something else with regard to tests for laboratory washing.

The National Association of Dyers and Cleaners, in

taking up the problem of shrinkage, loss of color, and trouble due to rubberized fabric getting ornamental designs on goods, called a meeting last year at the Hotel Pennsylvania, in which thirty textile trade associations were represented. The object of the meeting was to present certain tests which they tried to have adopted, so that the retail dry goods stores, when they sent their buyers to the market, would get samples of the fabrics which they desired to purchase, to send into a central laboratory to run according to these tests that we desired to institute.

At that time the meeting was adjourned, with the formation of a technical committee to go into it further. That committee was to investigate the subject a little further, but as yet there has not been anything definite done along that line. However, I understand that quite recently the Retail Dry Goods Association has gone on record as being desirous of putting a testing laboratory of that nature into operation, and I understand that some of the large department stores are now installing laboratories so that they can test their fabrics for maintenance to laundering and dry-cleaning.

President Killheffer—Is there any further discussion in connection with this problem?

Dr. E. C. Bertolet—Don't you think, with the many and varied uses of materials that are made by the textile industry, that it is almost impossible to look ahead at everything that a fabric is going to meet? I wonder just what per cent of the goods made is eventually dry-cleaned. There are a great many fabrics that are never dry-cleaned, like millinery goods, for instance. The style of the hats change before the goods are half worn out. With the changes in dress styles and women's wear, the life that a fabric has to stand is limited, because no one wants to wear a dress that is out of style.

President Killheffer—In fact, it is most disconcerting if you are married, I should say. (Laughter.)

Dr. Bertolet—There might be something you would have to put up with, though, at that stage. (Laughter.)

It seems to me that we can't legislate everything in every direction. It looks to me like the dry-cleaners have a problem, but it is their problem. I think, however, that the textile industry can make it a point to use faster dyestuffs on the materials that they produce. I really do think in many cases the dyeing of silk fabrics has been done with acid dyes, which will not stand cold water. I have also had some experience with the shrinkage of silk materials. But it seems to me that when it comes to trying to get the textile industry to use certain fibers in only certain stated ways, we are barking up the wrong tree. I don't think that can be controlled. I do think we can help them on the fastness of color. I think we can practically prevent water spots. I don't, however, think there is a remedy for every little thing. If we attempt that, pretty soon we will have organizations, and organizations, and overhead expenses, until the thing will become impracticable.

Mr. Jackson—I don't believe you realize fully the many materials that are cleaned. You mentioned millinery goods, for instance. You would be surprised to see how many hats are cleaned in a dry-cleaning plant. If you were to go into a dry-cleaning plant you would see hundreds of ladies' hats there that come in for cleaning.

I would venture to say that 99 per cent of the textiles that are put into use are cleaned or renovated by some method or other at some time during their life. The fact that a dress goes out of style doesn't prevent it from being renovated, because dresses are renovated and made over in new styles.

The problem is more than that of the dry-cleaner, because we have to work with what is submitted to us, and we have no control whatever over the manufacturer of textiles. I think it is a problem for the textile man, and one of vital interest for him.

For example, if the manufacturer who put out shadow velvet had made that material so it would stand renovating, he would have had a much larger sale. He went to a lot of expense, no doubt, to put that fabric on the market. If he had consulted with the dry-cleaner before he put it out, and made that fabric so that it would stand renovating, there is no question that he would have had a much larger sale. As it is now, if you go into a department store to buy that material they will tell you specifically that it cannot be guaranteed against spotting or renovating. There is absolutely no guarantee for that material. What is that going to create in the mind of the purchaser? The chances are she will not buy it. That reflects back on the manufacturer.

So it is more than the dry-cleaner's problem.

Dr. Bertolet—I still can't see how any organization can come to the textile industry and tell us just what fibers we can use, and what we can't use. The way to handle that is, if you find a fiber like Celanese silk, or some other fabric that won't stand it, we will have to discontinue the manufacture of that fabric.

Mr. Jackson—In the long run, that is going to happen, anyway. The consumer is the judge in a case of that kind. The consumer is going to be the judge of that fabric, and he won't buy it if he finds that it won't stand dry-cleaning.

Dr. Bertolet—There might be a place for that fabric.

Mr. Jackson—There will be a limited place for it, no doubt.

Dr. Bertolet—It won't be suitable for uniforms for football teams, or anything of that kind, but it will certainly have a place.

Mr. Jackson—Yes, but as I say, it will be limited.

Dr. Bertolet—I say again that the textile industry is

not to blame for a lot of these fabrics. They come to the textile man and say, "We want to produce a fabric for a certain price. You produce it." Then the middleman comes to us and says, "That is two or three cents too much a yard," and there is where you get the cheapening of the fabric. How are you going to control that?

Mr. Jackson—I realize that condition exists, and I think it can be controlled by proper co-operation all along the line.

I didn't mention the textile manufacturer here specifically. I had reference to all the men interested in the textile industry, from the manufacturer of the thread or the fiber to the consumer. I think it applies to all of you.

Dr. Bertolet—I still ask, How are you going to control it?

Mr. Jackson—By co-operation.

Dr. Bertolet—How are you going to get that co-operation?

Mr. Jackson—Mr. Goldman just mentioned one scheme.

Hugh Christison—Might I ask Mr. Jackson if he doesn't think that the more goods the dry-cleaner spoils, the better it is going to be for the textile manufacturer? (Laughter.)

Mr. Jackson—That is a rather short-sighted way of looking at it.

Just take, for instance, any one of these fabrics. We have ruined several dresses of this type in the dry-cleaning plants.

President Killheffer—Mr. Christison doesn't make that kind of goods.

Mr. Jackson—I haven't any woolen material here, but as that property which makes it impossible to renovate the material becomes known among the consumers, the material is certainly not going to be purchased, and the dry-cleaners, I assure you, are going to do all that they can to make it known to the consumers. (Laughter.)

Dr. H. C. Chapin—I can conceive of a way of solving that difficulty, although it may not be practical.

Your Association, I believe, has a laboratory. Are you prepared to supply to the manufacturer a mark which could be well advertised and certified, that goods may be dry-cleaned safely? If you were prepared to do such a thing and the manufacturer were prepared to purchase your certification, that would put the responsibility upon the dry-cleaner to dry clean that particular article.

Mr. Jackson—If a thing of that kind could be worked out, it would be a matter of getting together and co-operating on a scheme of that kind. I see no reason why that couldn't be developed and worked out.

Mr. Goldman—I can answer that still further and say that the National Association of Dyers and Cleaners are co-operating with manufacturers who are willing to submit their fabrics. I, personally, have tested a number of fabrics submitted by manufacturers of garments who desired to know whether they could stand dry-cleaning. We have tested them, given them our report, and they have put labels in their fabrics stating that they can be dry-cleaned. We are willing to have our members stand behind that guarantee.

President Killheffer—In other words, that answers Dr. Bertolet's question: that you can design certain fabrics, to stand certain usage, and you can pass on them, or your Association can pass on them. Then if you get materials of this sort that are designed to suit the whims or fancies (or whatever you wish to call them) of people interested in them, you can still get behind your statement that they will not stand dry-cleaning, because you will always have both kinds of fabrics with you.

Mr. Jackson—That is very true. I think it could be worked out on that basis.

F. A. Keyser—Filene's, in Boston, I understand, have their own chemist, and he tests goods for all requirements.

Eaton's, one of the largest houses in Canada, also has a chemist who tests all the goods they purchase. They test their goods to see whether they are suitable for ladies' hats, shirtwaists, bathing suits, overshoes, or what not. They send the goods up to the laboratory and try them for all these requirements. If they won't answer for one purpose, they might answer for another, and then they tell their salesmen what the material is good for, and they buy accordingly.

There are fabrics containing artificial silk used for overshoes up there now, where they have snow for about four months in the year. No one would think that Viscose could be used to walk around in in the slush and snow, but by being twisted with some worsted yarn, it holds together.

They make their own tests and say what the goods will do and what they will stand. They have their own chemist and what he says is final for them.

President Killheffer—We have overstayed our time on this subject, so I think we will pass on to the next one.

Mr. Jackson—If anyone wishes to examine these fabrics, I shall leave them here. (Applause.)

President Killheffer—The next paper I am sure will be of a very great deal of interest. I know it will be to those of us who are interested in the every-day testing of dyestuffs of all kinds and descriptions and in varying numbers. The title of the subject is, "The Use of the Spectrophotometer in the Dyestuffs Industry," and it deals with the evaluation of the dye content of commercial dyestuffs. This topic will be handled by Dr. Carl Draves, of the E. I. du Pont de Nemours & Co.

Dr. Draves! (Applause.)

Dr. Draves—Before starting my paper I should like to distribute these sheets because I have on them two tables of data. I present the data in this way in order to avoid

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the use of lantern slides. I will pass these around and anyone who is interested can take one and examine it.

. . . Dr. Draves then presented his prepared paper:

The Use of the Spectrophotometer in the Dyestuffs Industry

By Carl Z. Draves
E. I. du Pont de Nemours & Co.

The spectrophotometer, an instrument which can be used for measuring the relative concentration of colored substances in solution, is a scientific tool that has been available to the industrial world for a number of years. A considerable literature has grown up dealing with the use of the spectrophotometer in the solution of theoretical problems in the fields of chemistry and physics and many writers have shown that it can be employed in the estimation of dyestuffs. But so far as I know, there has never been a publication from within the dyestuffs industry itself which has presented any considerable data dealing with a wide range of colors to indicate whether or not spectrophotometric methods can be of commercial value to the dye manufacturer or purchaser. In this paper there will be presented to your Association the results of the experience of the Du Pont Company with the spectrophotometer as an aid in the accurate standardization of dyestuffs. A few points with regard to the technique employed in spectrophotometric methods also will be considered in a very general way.

The laboratory of the U. S. Bureau of Standards was the first in America to do any large amount of work with the spectrophotometer in the estimation of dyestuffs. Scientific Paper No. 440 of June, 1922, from that laboratory describes the apparatus and procedure employed in a study of the spectral transmissive properties of the seven permitted food dyes. Later Appel and his assistants in the color laboratory of the same bureau examined twenty-three competitive samples of an Acid Blue Black with the spectrophotometer and compared with the results with titration values and with values obtained by a special dyeing method.*

These authors urged dye manufacturers to adopt type standards for the more important colors, the characteristics of which could be defined with spectral absorption curves. H. Wales, W. C. Holmes and W. R. Brode are other Government chemists who have led in this country in the application of the spectrophotometer to the study of dyestuffs.

Since the principles of a spectrophotometric examination of a dye solution may not be wholly clear to everyone it perhaps will prove advantageous before going farther to explain the underlying idea very briefly by using a common example. A dilute acetic acid solution of Methyl Violet appears violet to the eye because white light which traverses such a solution has abstracted from it a large proportion of its green, yellow and orange. If a beam of white light after passing through a cell containing a dilute Methyl Violet solution is examined in a spectroscope which spreads out the beam into a wide rainbow of constituent elements of gradually differing wave lengths it will be observed that the two ends of the spectrum are nearly as bright as without the interposed solution. In the middle of the spectrum, however, it will be seen that there is considerable absorption of light and that the greatest absorption takes place in the yellow at a wave length of approximately 584 millimicrons. The mixture of violet, blue and red light transmitted by the Methyl Violet solution appears violet to the naked eye. The spectrophotometer is a device by which the proportion of light absorbed in the different parts of the spectrum by such a solution can be quantitatively measured.

Some Critical Observations with Regard to Technique and Instruments

For the determination of the relative strengths of two dye samples by means of the spectrophotometer it is necessary to compare the relative light absorptive powers of their solutions only at that portion of the spectrum where the absorption of light is at its maximum. In the case of Methyl Violet, as we have said, the maximum absorption occurs in the yellow at about 584 millimicrons. Since Beer's Law is valid for properly prepared solutions and within the differences in strength encountered in commercial samples, namely the relative concentration of a colored substance is proportional to the absorption in logarithmic units, a comparison of the readings for the two Methyl Violet solutions at this wave length gives a comparison of their relative strengths. Of course, this simple relation is true only when the comparison is made with the same size of sample and the same absorption cell.

It will be understood from this hasty exposition of the method that the spectrophotometer is not at all a colorimeter. Perhaps the hardest thing to make clear to the person who has had no experience in this field is that the latter instrument operates on entirely different principles. In a colorimeter solutions of both standard and sample are matched against each other simultaneously by varying the thicknesses through which light traverses the solutions until the depth of color for both is apparently the same. The operator sees the colors of the solutions in the instrument just as they appear to the naked eye. In fact, any slight differences in hue become very pronounced.

*J. Ind. Eng. Chem. 18,627 (1926).

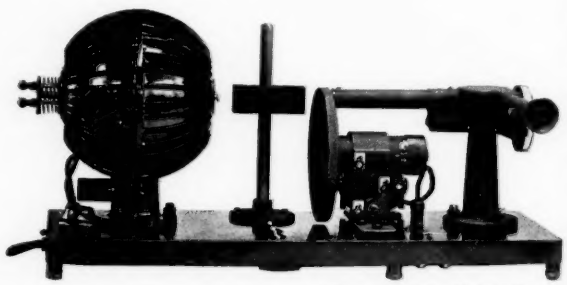
In the spectrophotometer, on the other hand, only one colored solution is inserted at a time. There are two beams of light in the instrument, however, one of which passes through a cell containing the dye solution and the other of which passes through an identical cell containing only the colorless solvent. Both beams are then dispersed into a spectrum by the same prism, and the same portions of the spectrum for both beams appear in the respective halves of the optical field. The intensity of the proper portion of the spectrum of the beam which has traversed the solvent alone is decreased by means of rotating sectors, Nicol prisms, or other device until it just equals the intensity of the light of the same spectral hue which has succeeded in passing through the solution of the dye and which appears in the other half of the optical field. After an absorption value has been obtained for the standard in this manner the same process must be repeated for the unknown sample. The ratio of the two light absorption values is equal to the ratio of the concentrations of the two dye solutions. It is evident that in such a method any personal idiosyncrasies in color matching are eliminated since light intensities of only the same spectral hue are compared. It is said that even color-blind persons are capable of such photometric comparisons.

That a colorimeter is indeed much less accurate than a spectrophotometer has been emphasized by Schertz in his report on a colored substance called xanthophyl.†

A similar inaccuracy has been found in our own laboratory in using a du Boscq colorimeter for comparing the strengths of oil reds differing slightly in hue. A sample bluer than standard appears much stronger against the standard when measured in a thick layer of liquid than when measured in a thin layer. Further, where there is a difference in hue different observers do not usually obtain the same results. Under these conditions even the same observer does well to check himself within 10 per cent in determinations of the relative strength of the same off-shade sample made on successive days.

Working Out Procedure for Routine Tests

For the routine determination of the strengths of dyes by means of a spectrophotometer a procedure must be developed which is both simple and reliable. This means that the proper concentration to get a suitable reading on the instrument, the proper method of dissolving the dye, the proper solvent for dilution to give a stable and insensitive solution and finally the wave length of maximum absorption, must be worked out for each individual dyestuff. The kind of solution in which the dye is examined and its acidity or alkalinity must receive careful consideration. Another condition affecting the absorption that has not been accorded the proper attention in the literature is the temperature of the colored solution. The safe procedure is to make up all final dye solutions of both standards and samples at exactly room temperature.



Courtesy Keuffel & Esser

A Color Analyzer

The filling of the glass absorption cell with dye solution is a part of the spectrophotometric method that must be accomplished with great care in order to obtain concordant results. The end glasses of the cell must be clean and dry and the solution must remain absolutely clear. It is difficult to obtain a perfectly clear solution in cells with screw caps on the end and also in cells put together with litharge and glycerine cement.

The type of instrument employed in spectrophotometric work is of the very greatest importance in attaining the speed and accuracy which should be demanded. A spectrophotometer for practical routine service in the determination of light absorption values must be easy of adjustment and when once adjusted must remain in that condition for long periods. It should be calibrated to read directly in logarithmic units in order to obviate the use of tables. Any spectrophotometer which requires several hours work for a trained physicist to set up and adjust and which is then easily disturbed because its parts are not rigidly fastened as integral parts of the whole, will never prove successful in control laboratories. At the present time only visual instruments seem to be sufficiently simple for reliable operation by the ordinary industrial technician. There is little doubt, however, but what the instrument of the future will be one employing a photoelectric cell with the entire elimination of the human eye in making photometric matches. For our work we are now using a specially designed Keuffel and Esser Color Analyzer that meets our requirements very satisfactorily.

The method perfected by Formanek for the determination of the relative strengths of dye samples requires only an accurate spectrometer without any photometric device. Use is made of the fact that the ratio of the

†J. Agr. Research 30, 253 (1925)

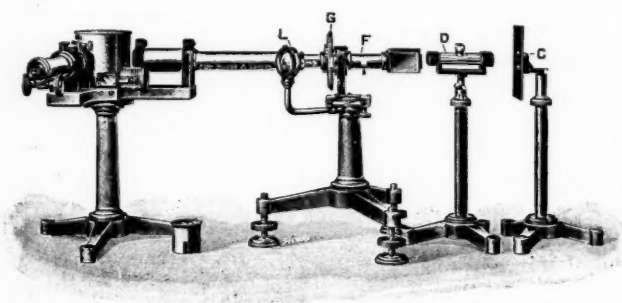
strengths of two dye solutions is inversely equal to the ratio of the lengths of solution required to bring the edge of the dark absorption band to the same wave length. A critical examination of the factors affecting the accuracy of strength determinations made in this way will make clear why all Government and university laboratories of this country no longer employ this method.

The Literature of Spectrophotometry

Although the primary purpose of this paper is to show the value of spectrophotometric methods and not to present at great length the theory and technique involved, it would not properly fulfill its function if it did not indicate the best sources of information for those who are interested in learning more about the details of the subject. The most complete treatise on spectrophotometry is Kayser's "Handbuch der Spectroscopie." Another old standard work is that of Formanek and Grandmougin entitled "Untersuchung und Nachweis-Organischer Farbstoffe." Still another book in the German is "Kolorimetrie und Quantitative Spektrolanalyse in Iherer Anwendung in der Chemie," by G. and H. Kruss. For those who do not read German there are two series of articles that should be read as an introduction to the subject. The first, by H. Wales, of the Color Laboratory at Washington, appeared in the American Dyestuff Reporter for 1923.* The second, by Prideaux, was published in England during 1926.† By far the best reference dealing with the physics of spectrophotometry and with spectrophotometric equipment is "The Report of the Optical Society of America Progress Committee for 1922-23."‡ This report contains an up-to-date bibliography that will prove very helpful.

The Value of Spectrophotometric Methods

Our discussion thus far has not concerned itself with the value of spectrophotometric methods to the dyestuffs industry. This phase of the question, however, must receive first consideration before managers can decide whether or not it is worth while to become interested in such methods.



Hilger Wave Length Spectrophotometer with Light Prism, with Nutting Photometer and Equipment.

The spectrophotometer will undoubtedly take its rightful place in the manufacture and testing of dyes when all concerned appreciate not only its uses but also its limitations. The uses in increasing order of importance are evident in the following kinds of work: (1) identification, (2) research, and (3) routine standardization and testing of dyestuffs.

The usual identification of dyes is based largely on the color changes which they undergo when treated with weak and strong acids and bases, or, in other words, upon upon their behavior as acid base indicators. The spectrophotometer simply serves as a refinement of technique in following these changes. But just as refinements of technique are often not necessary in other fields, so also here it is usually possible to make a satisfactory identification with the very quick and older spotting tests. However, it is true that the change in the ratio of the absorption values for light at two wave lengths from one pH condition to another is a very positive and beautiful proof of the identity of a dye even when such a change may not be very evident to the naked eye.§

The wave length of maximum light absorption of a dye solution is also a characteristic property which serves as a quick means of identification. But for the determination of this wave length a spectrophotometer is not nearly so satisfactory as a spectrometer of the type manufactured by Zeiss expressly for the purpose. The low dispersion and yet high resolving power of the latter instrument permits of the very accurate location of the wave length of the apparent center of the dark absorption band, the whole of which can be seen in the field of view of the instrument. The width of this dark band is best regulated by changing the length of dye solution in a Baly absorption cell.

Mr. Wilmot, of the A. C. Klipstein Company, has catalogued several hundred dyes in this way and has found this method very satisfactory for purposes of identification. It may be remarked that a buffer solution really should be used in making up the dye for this determination. The reason one can work fairly satisfactorily without it is that although the value of the maximum absorption usually changes perceptibly with a slight change in the pH of the solution near the neutral point, the location of the maximum changes but little, if at all. Extreme changes in acidity or alkalinity, on the other hand, often cause the complete disappearance of one absorption band and the appearance of another. The shift of the wave length of the maximum with dilution and with the addi-

*Am. Dyestuff Reporter 12, pp. 751, 791, 855 and 863 (1923).
†J. Soc. Chem. Ind., pp. 664, 678 and 697 (1926).
‡J. Optical Soc. Am. 10, 169 (1925).
§W. C. Holmes, J. Ind. Eng. Chem. 15, 833 (1923).

tion of alcohol is another characteristic property that may be used for identification.*

In both theoretical and industrial chemical research there will be found an increasing usefulness for the spectrophotometer. Purely scientific problems concerning the chemical structure of compounds can often be solved by means of this instrument. The behavior of indicators, equilibria between tautomeric forms and reaction velocities are other fundamental problems which have been found amenable to spectrophotometric methods.

To the research chemist in dye manufacturing a spectrophotometric laboratory can be of distinct service. It can give him the dye content of a whole series of samples for the study of improvements in process more quickly, more accurately and more cheaply than he could obtain such results by dye test. At the same time the relative purity of the different samples of crude dye can be reported from a consideration of the variations in the absorption curves. Even though the values for dye content from the instrument might not correspond exactly to the actual dyeing strengths of the samples, nevertheless, they are very satisfactory to use in the calculation of yield figures for the reason that they are not subject to the personal factor always attendant upon the judging of skeins which are not all of the same shade.

Although the most important use of the spectrophotometer for the dye industry at the present time is in the routine standardization of dyestuffs, this usefulness is in the determinations of strength rather than hue, or shade. Our experience has been that the absorption curves of solutions cannot be employed alone with reliability for the standardization of the dyeing hue of manufactured lots in comparison with standard prototypes.

Correlation of Hue with Absorption Curve

During a study of the correlation of dyeing hue with solution absorption curves for a large number of samples of different dyestuffs we found that whenever the absorption curves are nearly identical in shape dyeings obtained from the same samples are always very closely of the same hue. When the absorption curves are not the same the dyeings are invariably different except when the effect of differences in the proportion of impurities has been deliberately counteracted with a shading color. In other words, the absorption curves from the solutions of a whole series of lots of dyestuff standardized carefully for shade according to a standard dyeing method may or may not coincide. Lots whose absorption curves do coincide will dye exactly the same under any and all dyeing conditions. The lots whose curves do not coincide will match exactly only when dyed according to the standard method and when the dyeings are observed in the same light employed for standardization. It must be remembered also that colored impurities usually do not exhaust nearly so well as either the main color component or any added shading color. For this reason the absorption curve of a dye solution is not an exact measure of the result that may be expected on the fiber.

A consideration of these facts makes it clear why it is impractical either to predict accurately the dyeing hue of a sample in comparison with a standard or to attempt to calculate how much of shading color must be added to the sample to match the standard. And finally, as H. E. Ives has pointed out in a discussion of colorimeters, no color analyzing instrument can equal the naked eye for its delicacy in detecting slight differences in hue for color matching purposes.†

Even though it may be granted that the naked eye can hardly be improved upon for the matching of lots of dyestuff for shade, the accuracy and sensitivity of that organ for determining the strengths of dyes do not always wholly satisfy the conceptions of accuracy of plant chemists. However, in a discussion of the applicability of spectrophotometric examinations of solutions of dyes as a substitute for the older dyeing method of evaluating strength, one fact must be kept constantly before us. Most dyes are sold for the effect which they produce on a fiber or surface as observed with the eye and not for any physical property of their solutions.

Therefore a study of the accuracy of the spectrophotometric method for a decision as to its value in determining the strength of dyes must be made with a consideration of the accuracy from two viewpoints as follows: First, how accurately can successive determinations of dye concentration be carried out, that is, what is the average deviation of the process; and second, how close is the agreement between dye test and absorption values, that is, what is the average variation between the two.

With regard to the reproducibility of results with the spectrophotometer, the average deviation of a determination for most colors is about 0.5 per cent, except for yellows and browns, for which it is at least 1 per cent. We report our values to the nearest 1 per cent and expect that more than half the time a repeat determination will give the same figure and not a value one unit on either side. Stating it another way, a difference in strength between two samples can be detected with great certainty when the actual difference is even as small as 2 per cent. Such accuracy is better than can be attained with the dyeing method for which the average deviation of a single dye test is about 2 per cent for the vat colors,‡ and even greater for poorly exhausting colors such as the direct or sulphur dyes. It may be remarked, however, that

*W. C. Holmes, Loc. Cit.
†J. Franklin Inst., 673 (1915).
‡Am. Dyestuff Reporter 16, 337 (1927).

routine dye testing is usually carried out with much greater precision than many appreciate.

Factor of the Purity of the Dye

If a dyestuff were an absolutely chemically pure compound mixed with a certain proportion of chemically pure salt or other diluent, the dyeing strength of any sample would be exactly proportional to the amount of chemically pure colored substance in a solution of the sample. If one had the task of determining the strength of such an ideal and unattainable dye his first choice for a method of testing would be chemical titration because of its great accuracy in the hands of a skilled chemist. The second choice would be a spectrophotometric determination and the last the dye test. Commercial dyestuffs, however, are not chemically pure but contain greater or lesser proportions of chemical isomers, impurities from side reactions and shading colors. Because these foreign substances, which are not the principal color component do not affect the results from all three methods to the same extent, the dye test must remain for the present the only final authoritative procedure for the determination of dyeing strengths.

TABLE I

Comparison of Agreement of Titration and Spectrophotometric Methods with Dye Test

Av. Variation of Auxil. Method from Dye Test	Spectrophotometer Total No. of Lots	Spectrophotometer P. C. of Lots	Titration Total No. of Lots	Titration P. C. of Lots
0 to 2%	38	48	27	34
2+ to 3	9	11	8	10
3+ to 4	8	10	3	4
4+ to 5	9	11	5	6
More than 5	16	20	37	46
Grand total	80	100	80	100

Average variation for eighty lots: Spectro, 3 per cent; titration, 6.6 per cent. The eighty lots were distributed among forty-seven brands of all classes except the sulphur and vat dyes.

The spectrophotometric evaluation of dye content is far superior to chemical titration as a general auxiliary method to the dye test. Table I shows that for eighty standardized lots of dyestuff the average variation of the spectrophotometric strengths from the dye test was 3 per cent and of the titration values 6.6 per cent. As measured by these few examples the superiority of the spectrophotometric method in its agreement with the dye test was very marked. On the other hand, for certain colors, such as Indigo, Crystal Violet and some others, the agreement of the titration value with the dye test is all that could be desired. In fact, for several commercial dyes which are of extraordinary purity, chemical titration is the most accurate method of all for the evaluation of dye content. But the spectrophotometer has the distinct advantage of giving good results for the large majority of commercial dyestuffs which are not relatively of such great chemical purity. The reason the spectrophotometer usually agrees much better with the dye test is that colored impurities, if we can use that term, do not contribute their full dyeing strength and neither do they greatly increase the light absorption reading of a solution at the maximum for the dye because their absorption maxima are located in a different portion of the spectrum. These impurities are usually reducible with titanous chloride, however, and thus may largely affect the titration value.

Not only does the spectrophotometer agree better on the average with the dye test, but it can be employed for so many commercial dyes for which no satisfactory method of analysis by titration has been worked out. Any dyestuff which can be made up into a fairly stable clear solution in any solvent can be evaluated satisfactorily for dye content by means of a measurement of the light absorptive power of its solution.

Tests Made with Mixtures

Even mixtures give good results for strength by the spectrophotometric method when run against similar standards provided either that the absorption curve of the lot closely resembles its standard, or that the lot already has been standardized carefully for shade by means of the dye test. The titration of a mixture, on the other hand, is not at all satisfactory for an evaluation of dyeing strength.

It is true theoretically for either the spectro- or titration method that the proportion of two or more components in a mixture can be derived exactly from the mathematical solution of as many simultaneous equations based on independent conditions. Practically, however, for the usual commercial products such a determination is attended with sufficient error to vitiate the whole calculation. Ordinarily a complicated procedure of this kind proves a waste of time.

TABLE II

Variation of Spectrophotometric Values for Dye Strength from Dye Test Values

Av. Variation of Spectro-Values from Dye Test	Total No. of Lots	P. C. of Lots	No. Brands of Dyestuff
0 to 2%	424	46.2	117
2+ to 3	264	28.8	53
3+ to 4	98	10.7	29
4+ to 5	58	6.3	14
5+ to 10	59	6.4	23
More than 10	15	1.6	6
Grand total	918	100.0	242

Average variation for the 918 lots was 2.75 per cent.

The variation of spectrophotometric values of dye strengths from dye test values is summarized in Table II. The differences between the relative strengths by the two methods have been averaged for the several lots of each brand of dyestuff for which there is a separate standard. The many brands were then classified according to the magnitude of these average differences. For example, it was found during the standardization of the last twelve lots of our Pontamine Black EX Conc. that the average variation of spectrophotometric from the final and actual dyeing values was 1.9 per cent. Therefore, this brand of direct black is listed in the group for which the average difference was from 0 to 2 per cent.

Results obtained in this manner from the routine comparison of strengths by the two methods for 918 standardized lots of dyestuff distributed among 242 brands of 136 chemically different products should measure pretty well the agreement which may be expected in commercial production between spectrophotometer and dye test. All classes of dyes are represented in the data of the table except the sulphur and vat colors, with which we have not yet had sufficient experience to warrant grouping them with the others. All results for the period covered by the data of Table II have been included whether they were particularly favorable or unfavorable to the spectrophotometric method except where new standards have been adopted. For these cases only the lots manufactured since the adoption of the last new standard have been included.

It must be assumed for the purposes of this study that every lot examined was exactly 100 per cent in dyeing strength against its own standard because it had been standardized for actual dyeing strength by accepted dyeing methods. In reality, however, a lot which has been O. K.'d for shipment in the usual course of manufacture is only as close in strength to its prototype as can be attained by such dye testing methods. In other words, the lot may actually differ by 1 or 2 per cent from its standard in strength, although that difference cannot be perceived by the dye test.

The agreement of spectral values with actual dyeing strengths is really remarkable. If it is reasonable to assume that differences of less than 2 per cent in dyeing strength are not perceptible for practical purposes, then nearly half the time (or 46.19 per cent to be exact) the spectrophotometer agreed perfectly with the dye test. For about three-fourths of all the lots examined, the spectrophotometric method gave average results for strength differing by 3 per cent or less and more than eleven-twelfths of all the values differed by less than 5 per cent on the average. When the spectrophotometer varies from the dye test, by more than 10 per cent, the instrument is of little value as a check on the dyeing strength unless the difference for a given type of production is constant and in the same direction. However, for only 1.63 per cent of the tests was the average variation more than 10 per cent.

The Factor of Uniformity

A close examination of the original figures for the individual lots from which the data of Table II were summarized and a consideration of the circumstances during the manufacture of these lots reveal the following obvious conclusion: Conditions which tend to make the production of dyestuff more uniform in quality, lot after lot, are the same conditions which tend to make spectrophotometric strength determinations agree better with the dye test. Whenever the art of dye manufacturing becomes so perfected that successive lots of any dyestuff can be made absolutely uniform, the agreement between the two methods of testing will be perfect.

Because one cannot always learn that something has happened during the manufacture to suddenly change the quality of the dye, if even only slightly, he cannot always be sure that a certain spectrophotometric value for a lot means a definite dyeing strength as based on past experience for that color. When the situation does arise, however, that a spectral value deviates appreciably from previous values, it is always found that the absorption curve of the exceptional lot does not coincide exactly with the previous lots. If exhaust liquors from regular skein dyeings for the lots in question are examined, much greater differences are found in the shapes of the absorption curves than were evident in the original solutions. As W. R. Brode has pointed out, during the dyeing process there is a concentrating of the subsidiary dyes in the dye bath relative to the total amount of color which does not go onto the fiber.

Spectrophotometric examinations of solutions from exhausted dye baths for such cases give more valuable information than simple exhaust dyeings, because an exact quantitative estimation can be made of the proportion of the total original color that has remained in the bath.

From what has already been explained in this paper one would expect that spectrophotometric methods would have the least value and least reliability when applied to the testing of dye samples from different sources. Such, indeed, is the case. The correlation between light absorption values and actual dyeing strengths is much lower for the miscellaneous competitor's samples which pass through the laboratory than for our own products. Therefore, the buyer will find a spectrophotometer helpful for testing his purchases only when he obtains his successive batches of color from the same manufacturer.

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*J. Ind. Eng. Chem. 18, 708 (1926).

Discussion on Spectrophotometry

President Killheffer—Is there any discussion of this paper?

W. F. Deady—I should like to ask, Dr. Draves, if you have to make comparative tests each time, or could you make one test; for instance, take one dye and test it, and then make another test on the same dye, or a similar dye, some time later and get the same results?

Dr. Draves—If your buffer solutions are made up so carefully that they have exactly the same pH, and if you have an instrument which is in exact adjustment, the reading will be the same on successive days. But if you are not sure that your instrument is in exact adjustment, or that your buffer solution is of exactly the same pH, the safe procedure and the one which we follow, because we think it is simpler, is to make a new determination of the standard each time. The whole process is so simple that it is really easier to do this than to try to be so accurate with regard to the adjustment of the instrument and the condition of the buffer solutions.

President Killheffer—Are there any further questions?

Mr. Saraban—May I ask Dr. Draves in what way the Keuffel instrument has been modified for his purposes? Have you had the photometer drum calibrated with a logarithmic scale, instead of with a direct transmission scale?

Dr. Draves—The Kueffel instrument was modified for our special use at our recommendation, by having drum calibrated in logarithmic units, so that it is direct reading. Also, we have a different design for the illumination, so as to give a greater intensity of illumination for transmission measurements.

Mr. Saraban—I understand that in the original design there were two 400-watt lamps. You are using a stronger light source now, aren't you?

Dr. Draves—No, we have only two 200-watt lamps, but the illuminating box is much smaller, and the intensity with this instrument is much greater.

Mr. Saraban—But you still use the spherical shape?

Dr. Draves—No, there is a narrow illuminating box, much smaller than the spherical one in the old instrument.

W. D. Appel—May I ask how far out into the Violet you can measure satisfactorily? Can you measure Yellows?

Dr. Draves—We read as far into the Violet as 455 millimicrons. We don't attempt to go farther than that because the visibility is not great enough, but we get a fair and satisfactory accuracy at that wave length for the estimation of the strength of yellow dyes.

There are other good spectrophotometers on the market, of course. I am acquainted with several others, but we now have this Keuffel and Esser machine and we like it very much, although, as I say, there are other good instruments that are available for the work.

President Killheffer—Is there anything further in the way of questions or discussions? If not, we will pass on to Mr. Appel's presentation. He has asked me to make in condensed form an announcement that was requested by Mr. Priest, of the Bureau of Standards. Mr. Priest apparently has in preparation a bibliography of this whole subject, and requests that anyone who knows of papers or presentations which come in this field would confer a favor on him by either giving him the reference or submitting copies of those papers, so that they can be included in his complete reference work.

Mr. Appel! (Applause.)

Wm. D. Appel—The title of my paper is: "A Method for Measuring the Color of Textiles." Before starting it, I should like to remark that by modifying the illumination, by using a mercury lamp, Dr. Draves could extend his measurements from 450 millimicrons, or thereabouts, to two other points in the spectrum way out in the Violet—405 and 435.8 millimicrons—quite satisfactorily, because, as I shall point out, I am doing that for reflection measurements, which are still more difficult.

. . . Mr. Appel then presented his prepared paper:

A Method for Measuring the Color of Textiles

By Wm. D. Appel
United States Bureau of Standards

Under this title will be described a simple and relatively inexpensive method for measuring the reflection of colored fabrics and other surfaces at a few wave lengths in the spectrum. The method has been used by the Colorimetry Section of the Bureau of Standards for a number of years. Since April, 1927, it has been applied to dye and textile problems by the Dye Laboratory with the co-operation of the Colorimetry Section. A convenient form of the apparatus has been built for this work and will be briefly described and some of its applications indicated. A more detailed description will be published later.

Two general methods for measuring color are available. The first consists in matching the color with a colorimeter and expressing it in terms of the colored glass or gelatin fibers, wedges, etc., of the instrument used, or in the case of the monochromatic colorimeter in terms of three quantities, the dominant wave length, purity, and brightness of the color. The result obtained is dependent on the color vision of the operator and the quality of the illumination. A measurement made with daylight illumination, for example, will not indicate how the sample would appear by artificial light. Furthermore, the filters which are an essential part of most colorimeters are questionable as to permanence of color and as to reproducibility.

The second general method of color measurement consists in quantitatively measuring the reflection of the sample at close intervals throughout the visible spectrum. A spectrophotometer is required for this purpose. The result is a curve which is unique for the color. It is an analysis of the stimulus which evokes the color and is independent of the color vision of the operator and of the quality of the illumination. The curves are the fundamental specification of a color and from them by a series of calculations may be obtained a specification in any other system. For example, the curve may be used to calculate the color in terms of red, green and blue primaries, or in dominant wave length, purity and brightness. The color of the object under any specified illumination may be calculated from the curve. The spectrophotometric method, however, requires expensive apparatus, measurements toward the violet end of the visible spectrum are difficult or quite impossible on commercially available instruments, and because of the heat and intense light to which they are exposed in such apparatus, textiles often change color or fade during measurement.

These difficulties are avoided and partial spectrophotometric data which are sufficient for many purposes are obtained by the method to be described.

The relative brightnesses of a sample compared with a standard white surface at four definite places in the spectrum, namely at wave lengths 405, 435.8, 546.1 and 578 millimicrons are obtained in the following way: Sample and standard surface are illuminated with a mercury arc lamp which emits intense radiations at the wave lengths given and but little in the intervening portions of the spectrum. They are compared by means of a Martens photometer, using colored filters which transmit only one or another of the mercury lamp radiations.

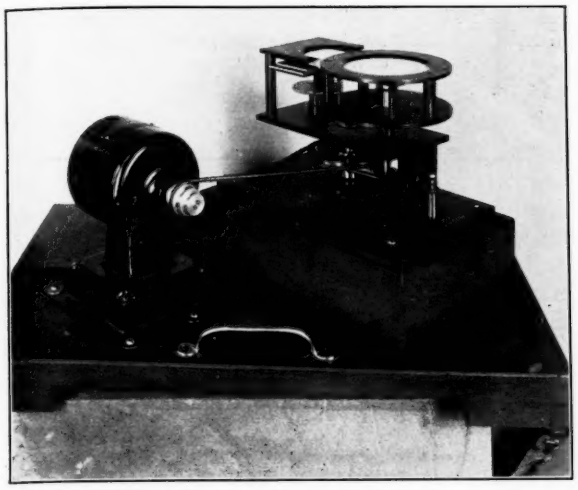
Here is the Martens photometer which you may examine after the meeting. Looking down into the instrument, there is seen a circular field divided into halves, one of which is illuminated by light reflected from the standard surfaces and the other by light from the sample. By rotating the head of the photometer the brightness of one-half of the field is made to increase while that of the other half is decreased. A position is readily found for which the two halves match in brightness. From the angle indicated by the pointer on the scale of the photometer, the relative brightness of the sample may be calculated.

When the illumination is that from a mercury lamp and a colored glass filter which transmits only the mercury line at 435.8 millimicrons is placed between the photometer and the eye, the relative brightness obtained will be for this wave length in the spectrum. Suitable filters will give similar values for the other wave lengths mentioned. Because of the discontinuous nature of the mercury light some variation in the transmission of the filters used with this source will not affect the measurements. Measurements at 405 and 435.8 millimicrons at the violet end of the visible are readily obtained, though they are not on the ordinary spectrophotometer.

By substituting incandescent lamp illumination and filters transmitting narrow spectral regions having effective wave lengths of approximately 501, 650 and 703 millimicrons, the relative brightnesses at three additional points in the spectrum may be measured. The incandescent lamp filters are not entirely free from the possibility of errors resulting from the color vision of the operator or from the nature of the color of certain samples, but for the majority of textile samples they are considered satisfactory.

In our apparatus shown in Slide 1 the mercury lamp and incandescent lamp are mounted in a metal box which can be shifted to the right to bring the mercury lamp directly above the sample holder and to the left to bring the incandescent lamp over it. A 220-volt mercury lamp and a 1,000-watt mazda C lamp are used. Openings in the light housing below the lamps permit the light to fall vertically downward. The sample holder is mounted on a carriage which slopes toward the operator at an angle

SLIDE 1



SLIDE 2

of 45 degrees from the horizontal so that the surface of sample and standard white are illuminated at an angle of approximately 45 degrees. The carriage is movable and may be drawn forward to make sample and standard accessible or pushed backward so that they are directly below the lamp. The photometer points downward perpendicular to the plane of sample and standard. The dividing line of the photometer is not placed in the vertical plane but in a plane making an angle of 45 degrees with the vertical. This necessitates the orientation of sample and standard shown in the photograph.

No attempt is made to insure equal illumination of sample and standard. Instead they are interchanged in position and an average of observations made before and after the interchange is taken. This procedure eliminates errors resulting from unequal illumination. It very greatly reduces the error which may result from the polarization of the reflected light and the use of a polarizing photometer and this error becomes negligible with the orientation of the photometer already described.

The surface effects of weave, twist, nature of warp and filling, etc., introduces peculiar difficulties to measurements of dyed fabrics, and different results are often obtained when samples are oriented in different ways with respect to illumination and observation. In order to average these effects and to increase the effective area measured, means is provided for rotating the sample during measurement.

The construction of the sample holder to permit rotation of sample and exact interchange in position of sample and standard is shown in Slide 2.

All except one of the filters used with our apparatus are combinations of colored glasses made by the Corning Glass Company, Corning, N. Y., from whom they may be obtained. The 501 mμ filter is Wratten filter No. 75, obtainable from the Eastman Kodak Company, Rochester, N. Y. The exact wave length to assign to this filter and to the other two filters for use with incandescent lamplight depends on the color temperature of the incandescent lamp, the spectral transmission of the filter, and the visibility function of the observer. It is expected that the manufacturers of these filters may be willing to determine the effective wave length for an observer having normal color vision.

The standard white surface is a plane matte porcelain plate covered with a fresh deposit of magnesium oxide obtained from burning metallic magnesium. For convenience, a plane ground matte porcelain plate is used as a working standard after its reflection with reference to magnesium oxide has been carefully determined.

A complete set of measurements, including twenty observations with each of the seven filters and duplicate observations with one of them to be sure that no change has taken place in the sample during measurement, requires about forty minutes. For routine work fewer observations may be sufficient and often measurements at only one or two wave lengths are required. The calculations are simple and may be made in a few moments on a special slide rule.

The precision of the measurements is indicated by the fact that the average difference between the first and duplicate measurements made at wave length 578 mμ for the first ninety samples measured on our apparatus is 1.12 per cent, which includes any change in color which took place during the measurements. Over two-thirds of the ninety samples show a difference between the first and second measurement of less than 1 per cent and an average difference under 0.5 per cent. These results were obtained by three men, none of whom had had previous experience in this kind of work. The precision at wave lengths 405 and 703 mμ for samples which have low brightness at these points in the spectrum would not be so high.

The values obtained by this method show a general agreement with those obtained with the spectrophotometer and diffuse illumination for samples that have a good diffusing surface. There are differences, however, which are no doubt connected with the differences between the two systems of illumination.

(Slides 3, 4 and 5, giving the spectrophotometric curves for diffuse illumination and values obtained with the present method of eight oriented samples, were shown here.)

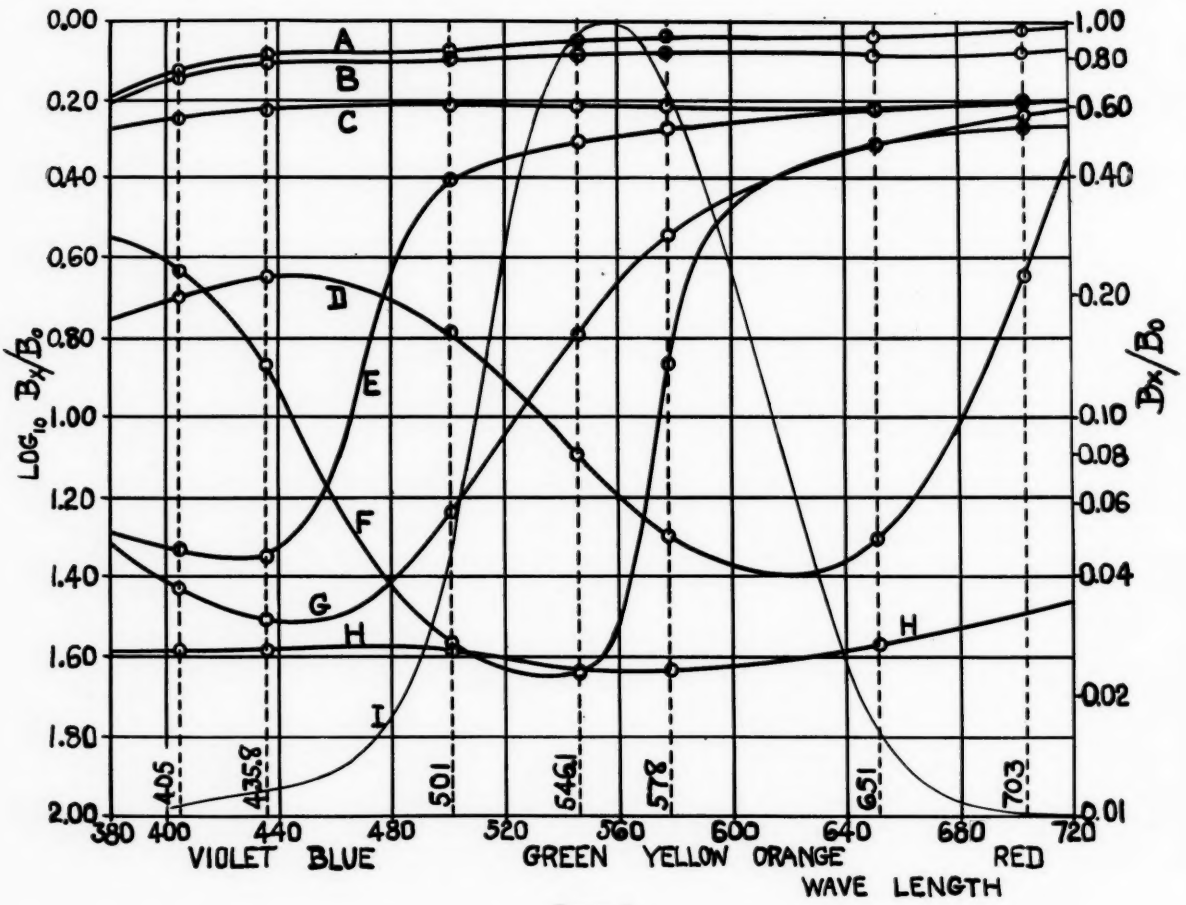
Illustrative curves of some typical dyeings are shown in Slide 6. In practice the logarithm of the brightness ratio is plotted as ordinate instead of the brightness ratio itself because the former more nearly represents the color

as seen by the eye. The relation between the brightness ratio and the log brightness ratio is shown in Slide 6.

Some of the possible applications of this method to dye and textile problems will now be referred to briefly. The relation between the weight of a given dye and the color of a fiber dyed with it may be shown as in Slide 7. The family of curves represents the undyed fiber, and 0.001, 0.2, 0.5, 0.75, 1.0 and 1.5 per cent dyeings of a yellow on wool. By plotting the values for these curves at any one wave length against the amount of dye, a second series of curves, Slide 8, is obtained from which can be read off the brightness at these wave lengths by any intermediate strength of dyeing. The family of curves for Alizarine Saphirole is shown in Slide 9 and the change in brightness at the several wave lengths with change in amount of dye used in Slide 10.

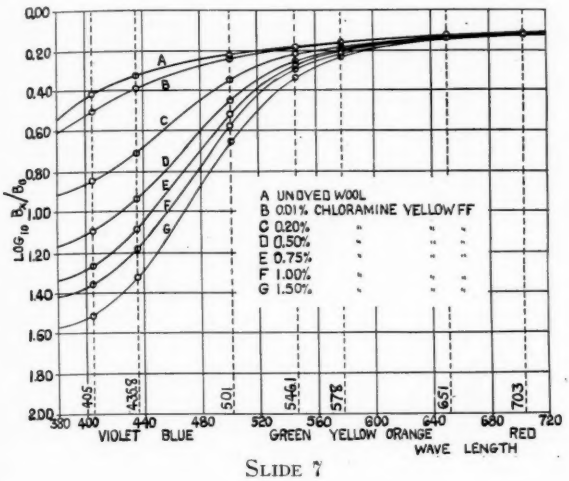
The problem of predicting the color of mixed dyeings is much more complicated and one on which we are not now prepared to report. Slide 11 shows curves for a yellow dyeing, a blue dyeing, and for a mixed dyeing of the yellow and blue.

The effect of washing on dyed fabrics is a relatively simple thing to follow with color measurements of the kind here described because it usually involves simply the removal of a certain amount of the dye. A silk dyeing of Alphazurine A, for example, which is measured after one, five, ten, twenty and thirty washings with neutral soap at 120 deg. Fahr., gives a series of curves which are in a very general way similar to the "dyeing" curves in Slide 7. Slide 12 shows this dyeing before washing and after thirty washings. Similar curves for Wool Violet 4BN are also shown and it will be noticed that this dyeing has changed much less in thirty washings than has the Alphazurine A. In fact, Alphazurine A and



SLIDE 6

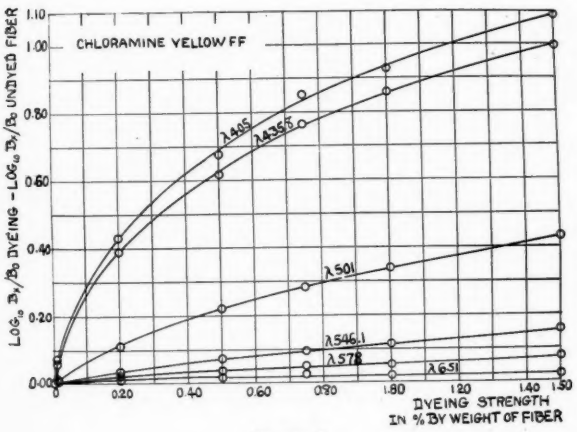
The brightness relative to magnesium oxide of a number of cloth samples at seven wave lengths in the spectrum determined with the Martens photometer and auxiliary apparatus. A—Silk cloth, four thicknesses, dark gray backing; B—Silk cloth, two thicknesses, dark gray backing; C—Silk cloth, one thickness, dark gray backing; D—Blue wool (1% dyeing of Alizarine Blue); E—Yellow wool (1% dyeing of Quinoline Yellow); F—Red silk (2% dyeing of Safranine); G—Orange Yellow wool (¼% dyeing of Pontachrome Yellow 3R); H—Black wool (6% dyeing of Hematine); I—Relative visibility curve.



SLIDE 7

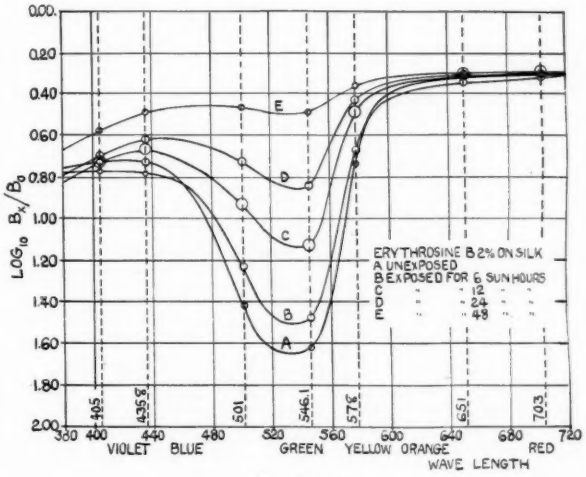
Wool Violet 4BN have been tentatively chosen by your Committee on Fastness to Washing of Dyed Silk as standards to represent the lower limits of classes 4 and 3, respectively, with references to alteration in color. Slide 13 shows similar curves for Diazine Black V, which changes much less in thirty washings than Wool Violet, and for Ciba Blue 2B which changes practically not at all.

The effect of light on the color of dyed fabrics is a very much more complicated matter than the effect of washing. It is not a simple "loss of colour," to quote an English article in which "colour" presumably means "dye," for the destruction of the dye by light often results not in colorless substances but in strongly colored ones which by no means disappear from view. The curves for the fading of Erythrosine in Slide 14 show that after a 6-hour exposure to sunlight the dyeing is actually reflecting less light at wave length 435.8 mμ although reflecting more at 578 mμ. After 12 hours' exposure the reflection is higher at 435.8 mμ than originally.



SLIDE 8

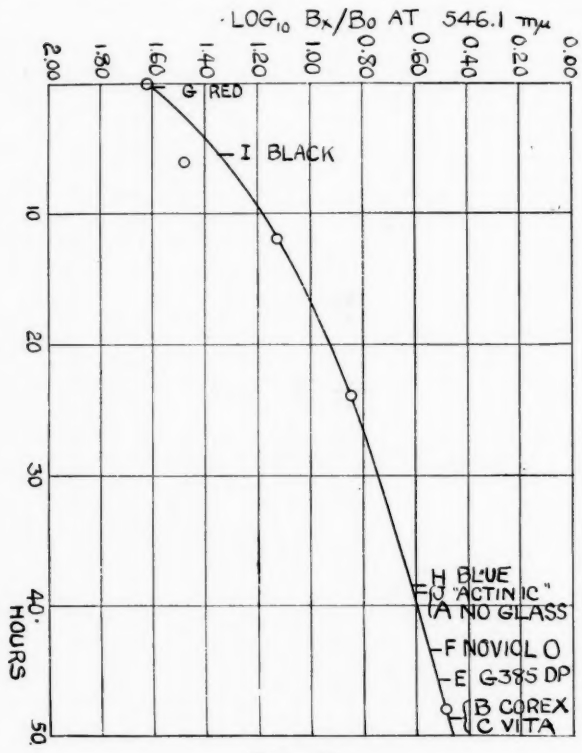
After fading curves like these have been determined, the fading as a function of time of exposure may be represented by a curve with time of exposure as abscissas and log. brightness ratios at a single wave length, preferably the wave length where the maximum change in brightness has taken place as ordinates. By this means a series of exposures of a dyeing made under conditions which have resulted in different amounts of fading but not in differences in quality of fading may be represented as points on the curve of the most faded sample. Slide 15 shows the fading of Erythrosine exposed under different colored glasses. This is one of the series 5 light exposures of your committee on light fastness.



SLIDE 14

The curves may be used to represent differences in quality of fading. Slide 16 is for Naphthol AS and Fast Blue G salt exposed to north sky light and the dashed curve to sunlight. The curves clearly show hue changes as in Slide 17. As an example of a complicated fading situation, Slide 18 has been made to show the changes in reflection of three different strength dyeings of Patent Blue A on wool.

From these examples it may be seen that the method offers a quick means of quantitatively recording the color and changes in color with which our industry is concerned. The spectrophotometer must be resorted to for the full story, but this is often unnecessary. The present method not only satisfies many requirements, but it is especially useful for routine work because: (1) Samples do not change in color during measurements; (2) Measurements at 405 and 435.8 mμ may be readily obtained; (3) The laboratory boy can use the equipment with very little supervision; (4) The apparatus is relatively inexpensive; (5) The results are not dependent on the color vision of the operator.



SLIDE 15

Erythrosine B 2% on silk. Brightness ratios at 546.1 millimicrons for samples exposed to sunlight. The small circles and the curve through them represent the change in the brightness ratio as a function of hours of exposure for a sample exposed under window glass at 45 degrees from the horizontal, facing south, on clear days between 9 a. m. and 3 p. m. The brightness ratios for simultaneous exposures of 48 hours' duration of identical samples under various other glasses are marked with short vertical lines on the curve. A—No glass cover; B—Corning Corex Glass; C—Vita Glass (Hues, Turner Glass Co.); E—Corning G358DP; F—Corning Noviol O; G—Corning Red Glass HR; H—Corning Blue Glass G584J; I—Corning Ultraviolet, transmitting Corex Red Purple; J—Actinic Glass (Pennsylvania Wire Glass Co.).

Discussion on "A Method for Measuring Color"

President Killheffer—Do I understand, Mr. Appel, that the use of the apparatus that you describe would perhaps permit of the use of some of our dyes. The other apparatus described would only permit the use of one certain dye, and they couldn't change to anyone else's. I was just wondering about this one. (Laughter.)

Mr. Appel—I have been afraid to try Newport's. (Laughter.)

President Killheffer—We are ready for discussion on this last paper.

Dr. H. C. Chapin—I was particularly interested in those curves on the Erythrosine and Rhodamine, for the reason that I was under the impression that the Erythrosine was fluorescent. I wonder what effect that would have.

Mr. Appel—The measurement you obtain is what you see with the eye. You are measuring the reflection of the visible light. If that light is obtained by fluorescence from an Ultraviolet source, of course that would be a consideration. With a different source, you might not get the same results. That is true. Perhaps you could eliminate that difficulty by inserting a filter in the mercury lamp which would cut out the Ultraviolet and yet transmit the visible. I don't know whether you could still make the 405 millimicron measurement with such a filter; I think you could the 435.8, because that is very bright now.

H. D. Clayton—I should like to ask if you could use that method for measurement of luster. You spoke about the difference in twist and the difference in weave affecting it, but is there any possibility of using it for that purpose on white goods, mercerized?

Mr. Appel—With the set-up that I have described, we try to avoid the regular reflection. The arrangement of illuminating at 45 degrees and viewing normally would avoid some of that. If you oriented the light and the sample and the photometer in a different way, you would get maximum regular reflection, and you might work out a method for evaluating it. In fact, I think there is a method. Jones has a method for determining luster or gloss by just some such means.

President Killheffer—Is there anything further on this subject? If not, we will pass to the next subject, "Washroom Practice in the Power Laundry and Its Relation to Dyed Fabrics," which will be presented by George H. Johnson.

Mr. Johnson! (Applause.)

. . . Mr. Johnson presented his prepared paper:

Washroom Practice in the Power Laundry and Its Relation to Dyed Fabrics

By GEORGE H. JOHNSON

Senior Fellow, Mellon Institute of Industrial Research

The almost complete lack of information that the modern mill chemist and dyer has with regard to power-laundry methods is astounding. A colored fabric may bleed when laundered, or fade if part of a damp-wash bundle and allowed to hang out-of-doors, and immediately the conclusion is drawn that the laundry which handled the piece has used "bleach" during the washing process. Woolens and silks are "boiled," to quote some letters from mill men who should know better, or are given "a very harsh treatment with laundry acids," to quote still another common excuse that is offered to a housewife who may complain about fugitive colors. The ridiculousness of such silly and unconvincing excuses for bleeding col-

ors is apparent on the face of it. The time has come when the dyer and chemist must recognize the fact that the laundry industry is fast being placed upon a scientific basis, and that the modern launderer may be as proficient and as skilled in his profession as any business man may become in any other line of industry.

Colored goods of many kinds, both dyed and printed, are sent to the power laundry every day. These fabrics and articles naturally are colored with many types of dyestuffs, some of which are fast to washing, others of which are moderately so, and still others of which are fugitive. It is the latter type of colors that has caused considerable trouble for the laundry industry, so that many launderers, in an attempt to protect themselves from what they honestly believe to be unfair criticism, in many cases have turned to cold-water washing methods for the handling of fugitive colors, even though the dirt-removing efficiencies of such detergents generally are less at tap-water temperatures.

When a housewife's bundle of soiled laundry reaches the modern laundry, it may be diverted into a dozen or more different groupings or classifications. These groupings, so far as colors are concerned, are as follows:

1. Light colored garments, such as bungalow aprons, dresses and similar pieces.
2. Dark colors that are suspected of being fugitive to soap and water.
3. Colored shirts.
4. Hosiery.
5. Overalls.
6. Colored curtains.
7. Colored woolens.
8. Colored silk or rayon pieces.
9. Rugs.

Dark colors generally are further sorted and laundered one color at a time, particularly if cold-water washing methods are not being used. For example, hosiery is subdivided into light and dark groupings which, although laundered by the some formula, are washed separately. Light colored garments and shirtings also are washed separately, although the same general formula may be used for each. Shirts containing a large number of white yarns are usually laundered at higher temperatures in order to remove the dirt more efficiently. It is a recognized fact, for instance, that better washing is obtained when using the average tallow soap at 140 deg. Fahr. than at 100 deg. Fahr., or at 170 deg. Fahr. than at 140 deg. Fahr. Hence, the launderer must use temperatures that will properly clean the white portions of a fabric without affecting the quality of the colored yarns that may be present.

There are at least three mistaken impressions about laundries that the dyer and mill chemist must recognize as being untrue. They are as follows:

1. Power laundries bleach colored goods.
2. Power laundries boil colored goods.
3. Power laundries use "acids."

From the start let it be understood that power laundries do use Javal water or sodium hypochlorite for white cotton and linen goods, but for three very good reasons: first, to brighten the white; secondly, to remove stains; and, thirdly, to sterilize the loads. However, Javel water is not used on colored goods in the well-operated plant, with the following possible exception, namely: garments or flat pieces wherein the predominating color is white. Such pieces include striped or checked shirtings, barbers' aprons which may contain a black stripe, and towels with colored borders, etc. These classifications of colored goods alone are subjected by some laundries to the action of Javel water, and only then in order, as mentioned before, to clear up the white. Fortunately, the cotton dyer apparently has chosen colors for these classifications with an eye open to the fact that the dyed yarns may be woven with uncolored yarn and then be bleached in piece form afterward. At any event, very little trouble is experienced when laundering such materials. The temperature of the bleaching operation, so-called, varies with the laundry from 120 to 170 deg. Fahr.; the duration of the bath, as a general rule, averages five minutes; and the washwheel concentration of available chlorine as recommended by the Laundry-owners' National Association is 0.01 of 1 per cent or less. Under these conditions, the laundering loss of tensile strength for white cotton is less than 6 per cent in twenty washings. In other words, even when white cotton is subjected to the action of Javel water, if this supply is used as recommended, after twenty washings cotton goods will be from 94 to 97 per cent as strong as they were originally. It is only when sodium hypochlorite is misused that cotton or linen suffers, and that fact is true of mill as well as of laundry practice.

Temperature Control Important

Let it also be stated that the power laundry is doing more to control the temperature of the three to four suds and five rinses used for removing dirt from cotton colored goods than is the housewife herself. Practically every modern washwheel that is being made to-day is equipped with a thermometer; and even in the case of old equipment the launderer is rapidly becoming interested in providing thermometer control for his older wheels. He, furthermore, is coming to

rely more upon the use of preheaters and hot-water heaters rather than upon live steam for obtaining hot water as needed. Some launderers, let it be pointed out, have equipped their washwheels with recording thermometers in order that they may control their washmen more effectively, while others even have their washwheel temperature thermostatically controlled. This interest in temperature control has been taken by the laundry industry because it recognizes, first, that hot water must be used for white work and, secondly, that the rate of bleeding of most colors increases with a rise in temperature, this fact being especially true of the direct cotton colors. The following are the washing temperatures recommended for the various classifications of colored goods that come to the power laundry:

1. Light colors and solid-shade shirtings, 100 deg. Fahr.
2. Colored shirts, 120 deg. Fahr.
3. Striped shirts with white areas, 140 deg. Fahr.
4. Cotton fugitives, cold to 100 deg. Fahr. (In winter the temperature of tap water may be as low as 40 deg. Fahr. and in summer it may be as high as 75 deg. Fahr.)
5. Hosiery, 90 to 100 deg. Fahr.
6. Overalls, 160 to 180 deg. Fahr.
7. Colored curtains, 90 to 100 deg. Fahr.
8. Colored woolens, cold to 100 deg. Fahr.
9. Colored silk and rayon pieces, cold to 100 deg. Fahr.
10. Rugs, cold water.

It will be noted that every attempt is made to keep temperatures down to a minimum. Only in the case of striped shirtings, which are washed at 140 deg. Fahr., and overalls, which are laundered at 160 to 180 deg. Fahr., does the recommended temperature exceed 120 deg. Fahr., and in these two instances higher temperatures are required either in order to properly clean the white portions of the shirts or to remove heavy grease and oil stains from the overalls. In most cases the temperatures used do not exceed 100 deg. Fahr. In the case of overalls, a dyer has no excuse for using any colors that are less fast than the sulphur dyestuffs or Indigo, considering the uses to which work clothes of this nature are put.

Washing Practice vs. "Acids"

The assertion that laundries wash colored goods in "acids," thereby inferring that colors are destroyed and textile fibers are tendered, is another myth having no foundation whatever. Anyone who is familiar with the mechanics of washing knows that dirt removal is based upon the use of soap and alkaline solution, which, because of their low surface tension, have the property of wetting out cloth and dirt very easily. The friction that is obtained by lifting the loads by means of ribs inside the revolving washwheel cylinder and then dropping them into the suds loosens the dirt particles. (A washwheel is very similar in construction to a hosiery dyeing machine.) The soap then surrounds each dirt particle or each globule of oil, if an emulsion has been formed, with a film of soap. If too much dirt is loosened for the soap that is present to take care of, then the suds "fall" because not enough soap is present in the bath. Acids have no such reaction upon dirt. It is perfectly true, however, that at the end of the washing formula the launderer, like the mill bleacher, may use a sour to neutralize any excess alkalinity. These sours may be listed as acetic acid, oxalic acid, sodium silicofluoride, sodium acid fluoride, and sometimes sodium bisulphite. Of these five types of laundry sours, oxalic acid alone may be classed as harmful to cellulose, and even this sour is harmless when rinsed from the load previous to drying or pressing.

The average soap concentration present in a washwheel usually varies from 0.1 to 0.15 of 1 per cent. The amount of alkali present will vary from one-half to one-tenth of this concentration, depending upon the type of alkaline builder that is used. In the case of soda ash, for example, the alkali concentration for colored goods will be about one-third that of the soap. When a neutral or modified soda is used, the concentration will be about one-half to three-fifths that of the soap. If caustic soda is used, the concentration will be about 0.01 of 1 per cent. There is no set rule that can be given, because the amount of alkali that is used will vary with the builder that each launderer uses.

The following are typical washing formulas for colored goods:

Light Colors

First Bath—Water at 90 to 100 deg. Fahr. Add a mixture of three parts by weight of soap and one part of soda ash or its equivalent and run ten minutes.

Send Bath—Warm water at 100 deg. Fahr. Add soap and alkali to produce a good suds and run ten minutes.

Third Bath—Repeat.

Fourth Bath—Repeat.

Fifth Bath—Warm rinse at 100 deg. Fahr. for five minutes.

Sixth Bath—Repeat.

Seventh Bath—Repeat.

Eighth Bath—Repeat.

Ninth Bath—Cold rinse and sour with acetic acid.

[Note: (1) Striped shirts containing a white ground are laundered according to the same formula, except that the temperature of the third and fourth baths and the first four rinses will equal 140 deg. Fahr. (2) Dark colors are washed with a formula similar to the one just given, although some launderers prefer to use cold water.]

Hosiery

First Bath—Water at 90 to 100 deg. Fahr. Add soap and builder, generally as a stock solution, and run ten minutes.

Second Bath—Repeat.

Third Bath—Water at 100 deg. Fahr. to half cover the goods. Run five minutes.

Fourth Bath—Repeat.

Fifth Bath—Repeat.

Overalls

First Bath—Water at 100 deg. Fahr. Run five minutes.

Second Bath—Hot water. To a 100-pound load of greasy overalls add 5 pounds of soda ash and 8 pounds of common salt. Run ten minutes.

Third Bath—Repeat. The temperature reached in this bath will be about 150 deg. Fahr.

Fourth Bath—Repeat. In this case the temperature will equal 170 to 180 deg. Fahr.

Fifth Bath, etc.—Rinse with hot water until water runs clear.

Colored Woolens

First Bath—Water (tap to 100 deg. Fahr.). Add soap solution and run ten minutes.

Second Bath—Repeat, if necessary.

Third Bath—High rinse for two minutes.

Fourth Bath—Repeat.

Fifth Bath—Repeat.

Sixth Bath—Repeat.

[Note: (1) Very high water levels are used for both suds and rinses to avoid undue pounding action. The washwheel is stationary between baths for the same reason. Many laundries are equipped with special wool washers. (2) Colored silk and rayon pieces are handled in much the same way as colored woolens, except that lower water levels are used. In some cases such pieces are washed entirely by hand.]

In conclusion, let it be repeated that the methods used by the up-to-date power laundry will pass inspection in by far the majority of cases. It no doubt is true that there are some laundries that do not follow the recommendations of the L. N. A. with regard to the handling of colored goods, but the fact remains that these plants are meeting more and more competition from the better operated laundries of the day. It is only a question of time until these plants either will have to clean house or else they will be forced out of business because of keener competition. This trend has occurred in other industries; it will repeat itself in the laundry industry unless all signs fail.

The following episode, which occurred in one of the department stores of a large American city, is a typical example of an unsatisfactory color situation and the unreasonable attitude adopted by some concerns in the handling of claims for fugitive colors. A woman purchased a colored dress which, after a short period of wear, was laundered by hand with lukewarm water and Lux, a good grade of neutral domestic soap. Although the dress was handled carefully, it bled badly. Upon complaint to the store, the customer was asked how the dress had been laundered. The customer described the method used and mentioned the fact that she had used Lux.

"Unfortunately, madam, you have made a great mistake. You should never have used Lux; you should have used Ivory Flakes."

Not being satisfied with this sort of an adjustment, the woman saw to it that another similar dress was purchased and was laundered in lukewarm water with Ivory Flakes. Again the same bleeding occurred. When a second person complained at the store in question and mentioned the fact that Ivory Flakes had been used, the adjuster exclaimed, "You should never have used Ivory Flakes; you should have used Lux."

Is it any wonder that the American housewife is beginning to lose her faith in the quality of dyed materials?

Discussion on Laundry Practice in Relation to Dyed Fabrics

President Killheffer—Before I ask for any questions, I have one or two I should like to ask you, myself, Mr. Johnson.

This astounding lack of information which you refer to on the part of the average mill chemist I think may be somewhat of a misapprehension on your part also. The fact is, as I understand it, that most cases that come back to the mill chemist are cases where there has been trouble experienced. In other words, in the cases where the laundering has been up to the standard which your Association recommends, most likely no complaint ever goes back to the source of the cloth. But, unfortunately, there are laundries that are most modern in their equipment from stem to stern that aren't members of your Association. I have one in mind at the moment. I don't think it is a member of your Association. In fact, I know it

wasn't the last time I inquired. This laundry makes a very generous use of chloride of lime because, as one of the owners of the establishment explained to me (only after a good deal of questioning, and with some evidence that I had) their washroom superintendent had discovered that their washing time was greatly reduced and their fabrics came out much better by the more or less judicious use of a little chloride of lime, and that at a temperature that is hardly reasonable.

This is how I came in contact with this particular case: a mill which had been putting out a fabric dyed with a vat dyestuff with a guarantee of the fabric against washing had received a complaint based on a result obtained in a laundry. When I saw the result obtained, I knew there was only one thing that would give that result with that particular color, and that was chloride of lime. So I obtained about a square yard of this cloth and sent it to this laundry that I speak of, which is not far from here, with no comments at all. I simply put it in the bundle of stuff that went to the laundry in the usual course, colored, white, and so forth. When it came back, it looked hardly as good as the piece that had originally been complained about. Following that I went to see the laundryowner, and the rest of the facts that I have recited to you developed: that they were using chloride of lime.

There are enough textile men here who can give you their slant on the question, if I am not correct, but those are the kind of cases that get back to the textile chemist, those cases where a good color has gone wrong and where it isn't his fault at all, and that is what influences him perhaps in the thought that these laundries are not behaving themselves as they should.

This laundry or these various laundries may be outlaws more or less, it is true, but some of them are extremely modern. This one I have in mind is, except for this wonderful discovery of theirs about what chloride of lime will do. What are you going to do with a laundry like that?

Mr. Johnson—Dr. Killheffer has brought up a very moot question. I think we can answer it in this way: I don't think any textile man in this room will guarantee the product of every mill. I don't think that Mr. Jackson, or Mr. Goldman, would recommend the work done by every dry-cleaning establishment. Neither can I recommend the work done by every laundryowner in this country.

I might point out that our Association has 2,300 members that are scattered all over this country and Canada. Those 2,300 members are probably doing between 60 and 70 per cent of the business that is done in this country.

I think the time is coming, Dr. Killheffer, when the situation that you speak of (and which we realize exists) is going to iron itself out because, as I pointed out in my brief talk, the day of closer competition is coming. There is a tendency toward mergers in the laundry business. Big money is beginning to get interested in it, and I think the day is coming when a plant of the type Dr. Killheffer mentions is going to be made to clean house or get out of business.

I might say that at the present time there is a movement in the Laundryowners' National Association to draw up specifications and definite standards which a laundry must meet. We hope that some day this will mean that no laundry can be a member of the Laundryowners' National Association which does not meet those specifications and standards. I think the day is coming when the situation about which you complain will be cleared up.

Dr. C. S. Hollander—Mr. President, we had a case come to our laboratory that was very similar to the one you described. When we saw the case we naturally tried one of our products on it and cleared the situation very quickly. It was a case of Indanthrene GCD that had turned green. We wrote to your association at that time, Mr. Johnson, to find out whether they had ever given the laundryowners an idea as to how to bring such colors back.

Mr. Johnson—That has been taken care of, sir. The method that you suggested was published. We were glad to take advantage of it, and it was published in the November Laundryowners' National Association Bulletin of this past year. It has already been given out by the National Association.

President Killheffer—I raised that same question with the laundry I spoke of, and they professed complete ignorance that there was any such thing either as an antichlor or chemical that might bring back a dye, and the dye in question was also Blue GCD. (Laughter.)

Dr. Hollander—Probably this same one.

Hugh Christison—I should like to ask Mr. Johnson what kind of worsted or woolen garments are sent to laundries to be washed.

Mr. Johnson—We handle a great deal of hosiery, particularly golf hose. We frequently get woolen underwear, stockings, blankets and materials of that type. I will have to confess that a large amount of it goes to the dry-cleaner, but we get a good many woolen blankets and similar materials.

President Killheffer—There should be plenty of discussion on this paper.

W. F. Deady—I think a lot of goods that are put out for a price really shouldn't be washed. For instance, I know we dye a lot of direct colors. We have to do it for a price, and we have to use direct colors. We couldn't use developed or vat colors. We don't guarantee those to be fast to washing, or anything, but some of those eventually find their way to the laundry. I don't think it is the mill's fault. I think it is more the fault of the men

who send the goods to us to be finished. Some of them guarantee them.

Mr. Johnson—There is a lot of truth in what you say. I don't know if any of you saw the advertisement that appeared in yesterday's New York Times, a full-page advertisement of a type of shirting guaranteed to stand at least 365 launderings. Just stop to think what that means. It means that if that shirt is laundered once a week, it will last seven years. (Laughter.) If it were laundered once every two weeks (which is the case usually with material sent to the laundry, since it goes to the plant every other week), that means it would give fourteen years of service.

The point that Mr. Deady brings up is a mighty important one, because I believe that the term "guaranteed" has been burlesqued. I think the term "guarantee" has come to mean in a good many cases nothing more than a replaced garment in case a customer complains, and there are very few that complain.

That is a very important point you brought up, Mr. Deady, and that is one thing you are suffering from. You cannot blame the laundryowner if he feels that he is not at fault for that type of damage.

G. A. Moran—I think you remarked that the treatment with Javel water left the goods about 94 to 96 per cent as strong as before the treatment. That would mean an average loss of about 5 per cent. Does that mean that after twenty washings there wouldn't be anything left? (Laughter.)

Mr. Johnson—The point I brought up, sir, is simply this: that a good many people don't realize that wear has a good deal more to do with the deterioration of materials and textiles than is commonly supposed. The point I make is that 6 per cent loss represents a good loss on white cotton work for twenty washings. We have taken twenty washings, because we find that we can send test pieces through a laundry and that will take just about a week's time, and therefore we can check up that process quickly and effectively and know whether or not a laundryowner is bleaching properly. There is no specific reason for taking it. You can take fifty washings, if you want, but the point is that if you use Javel water as it should be used, and as recommended, the tendering loss is not nearly so great as is commonly supposed.

President Killheffer—According to your thought, after twenty washings, you would get your shirt back in solution. (Laughter.)

Mr. Johnson—I might point out that in the case of rayon that occurs. (Laughter.)

President Killheffer—Are there any further questions?

H. J. Helliwell—Have you ever found that Escolite has any effect on washing?

Mr. Johnson—I see no reason why Escolite should have any more effect on washing than any type of alkali.

President Killheffer—Is there anything further on this subject?

Mr. Johnson—I might say that the tables to-day are reversed. Last June I was at a convention in Del Monte, Calif. At that time there was a textile man where I am now and laundryowners where you are, and you should have been at that meeting. (Laughter.)

President Killheffer—In other words, men, here is your chance! (Laughter.)

P. J. Wood—It seems to me there has been a great deal of talk in the last few years on the question of fastness.

From Mr. Johnson's talk, I gather that the average temperature at which goods are washed is 100 degrees, with certain exceptions, and we are asked to make them fast to boiling—and I imagine some would like it better than that even. (Laughter.)

I think if any of these committees get to work, the first thing they should do is to clear the atmosphere of all this nonsense. In my opinion, the matter of fastness has been worked overtime. It has been salesmen's selling slogan, "Our goods are fast." They didn't care whether they were or not; if they could go out and say that, they just simply had the edge on the other fellow.

I think the sooner we get down to business and recognize the facts as they have been stated to-day, and make our colors reasonably fast, in other words, so that they will stand the actual requirements of the laundry (and not some imaginary requirement to which they are never subjected), the better it will be for all parties concerned. (Applause.)

President Killheffer—Is there anything further? This is your last chance now. If not, we will pass on to the next paper. (Applause.)

The next subject on the program is "Mechanical Dispersion and the Colloid Mill," by P. M. Travis. (Applause.)

Mr. Travis—Mr. Chairman and Gentlemen: Before starting this discussion on the colloid mill, I wish to state that, unfortunately, in our application of colloid mills, the mill is only about 30 per cent of it and the other 70 per cent is knowledge of colloidal dispersion, and the application of what I call mechanical chemistry. I shall run over briefly some of the elementary principles in dispersion which we must bear in mind at all times while working with the so-called colloid mill.

. . . Mr. Travis then presented his prepared paper:

Mechanical Dispersion and the Colloid Mill

By P. M. Travis

Travis Colloid Research Company, Inc.

The colloidal state is usually defined as that state of matter in which the ultimate units in solution are no longer isolated molecules or ions, but aggregates of

molecules, for which Naegeli introduced the term micella, or small crumb. The essential characteristics of the constituents of colloidal solutions are therefore very small ultramicroscopic particles, of which the dimensions lie between the molecular and microscopic sizes. These particles (ultra-microns) have the same relations in colloidal solutions as the isolated molecules have for the crystalloidal solutions. By proper manipulation almost any substance which exists in solid state can be produced in solution, either as a colloid or crystalloid, and in a large number of cases it is merely a question of the concentration of the reacting components; whether the crystalloidal or colloidal state results. Modern work has therefore shown that it is incorrect to speak of colloidal substances as a particular class, and it is therefore better to distinguish between the colloidal and crystalloidal states of matter than to speak of colloids and crystalloids.

Emulsification

For the past twenty years emulsion has been the subject of lively comment in chemical literature; and while no general theory of emulsification has been elucidated, many have been proposed from time to time, only subsequently to be shown to apply to special cases. There is, however, a mass of arbitrary data which can be profitably applied.

An emulsion is a system containing two liquid phases, one of which is dispersed as globules in the other. That liquid which is broken up into globules is termed the dispersed phase, while the liquid surrounding the globules is known as the continuous phase or dispersing medium.

For emulsions of oil in pure water the stability is influenced by (a) the interfacial tension, tending to bring about coalescence of the globules, whereby the total surface would be reduced; (b) the Brownian movement, tending toward collision of the globules, a factor operating against stability; and (c) the electrical charge on the globules, tending to repel them from each other on near approach.

The present generally accepted theory of the formation of homogenized emulsions postulates the presence of a stabilizing film around the dispersed phase, which prevents the particles from coalescing when they come into contact with each other, due to the Brownian movement. This protecting film is the emulsifying agent used, which surrounds each particle of the dispersed phase of the emulsion.

Oil-in-Water Emulsions.—The most common emulsions are those in which the oil is dispersed in the water. In all emulsions where the concentration is over 2 per cent it is necessary to have a third substance present, which is known as the emulsifier or emulsifying agent. For example, in the case of a dairy emulsion, such as butter fat dispersed in milk, casein is the emulsifying agent, while in the case of a chocolate emulsion, where the cocoa fat is emulsified in the chocolate liquor, fine particles of cocoa powder which accumulate about these fine globules of cocoa fat act as the emulsifying agent

Water-Soluble Colloids as Emulsifying Agents.—Good emulsifiers of this class are sodium and potassium soaps, egg albumin, gelatin, glue and other water-soluble proteins, gum arabic, Irish moss, casein, starch, saponin and various bark extracts. NaOH was classified as an excellent emulsifying agent for fatty oils in water, but Donnan's investigation showed that its emulsifying powers were really due to the soap formed by interaction with the small amount of free fatty acid that is always present in fatty oils.

There is a very simple method of determining the type of emulsion. Water added to an emulsion of oil-in-water will disperse. Similarly, a water-in-oil emulsion will mix with oil. In short, an emulsion will mix with more of the constituent which forms its external phase, but not with that which forms its internal phase.

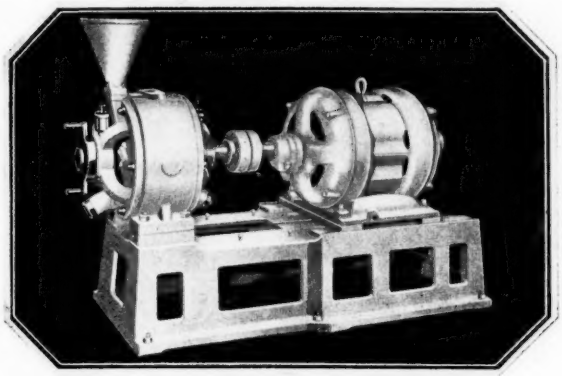
The Stability of Emulsions.—We have already noted that concentrated emulsions demand the presence of an emulsifying agent. In such cases the stability of the emulsion depends on factors relating to an adsorbed film at the oil-water boundary.

Electrical Concerpts in Colloidal Dispersions.—It is generally conceded that in the colloidal state the particles carry an electrical charge; or, in other words, that there is a potential difference between the liquid and the micellae dispersed therein. To determine the nature of a charge on a colloid we may compare the various concentrations of electrolytes required to produce turbidity or approach the iso-electric point.

Peptization.—By "peptization" is meant the diminution of the size of aggregates, and peptization is, therefore, the reverse of flocculation or coalescence of aggregates. The mechanism of the diminution of size of aggregates is not always the same. Often by the use of peptizing agents it is possible to use them in conjunction with fine dispersion in treatment through colloid mills where they are of some value in assisting in dispersion, using small quantities in conjunction with mechanical dispersion.

Stability of Dispersions.—Frequently the dispersed solid does not remain in the colloidal or suspended condition. We have seen that these particles while in suspension are, as a rule, electrically charged, and that all the particles in a given suspension have the same kind of charge. For example, in some suspensoids the particles all carry a positive charge, while in others

they carry a negative charge. In either event the particles in any given suspensoid all have the same charge and naturally repel each other. This, of course, tends to keep the particles apart, preventing the formation of a clot or precipitate, thus tending toward stability. Acting counter to this, however, is the surface tension



One of the Smooth Surface Types of Colloid Mill Used Extensively in This Country.

between the solid particles and the liquid. The action of surface tension is always to draw the object into the smallest possible volume for a given mass. A good example of this is the action of mercury, which, when thrown upon a table, forms little spherical particles. In the case of colloids this tends to draw the small colloidal particles together, forming larger particles which are the units of clots or precipitates.

We have, then, these two forces acting counter to one another, and we can readily understand the action of electrolytes in causing precipitation. When so-called colloidal solutions are exposed to the air, precipitation often takes place, probably due to the fact that the air contains a large number of electrolytes, which are adsorbed.

Colloidal Dispersions.—Dispersed systems can be formed in two different ways: (1) By subdividing coarse material into fine particles, which is classed as the dispersion method; (2) by condensation of molecules or groups to colloidal size, which is what occurs in the case of electrical and chemical methods. It is case 1 in which we are interested—that is, mechanical dispersion—and accomplish it by use of the so-called colloid mill, which is sometimes spoken of as a homogenizer, but must not be confused with the pressure type of machine used for making emulsions and which is not adapted for such dispersion.

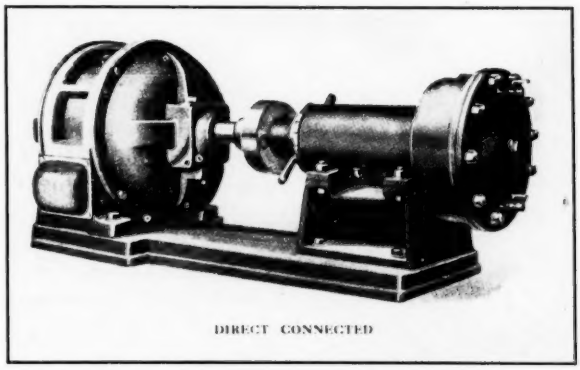
Colloid or Dispersion Mills

To H. Plauson, a Russian engineer residing in Hamburg, is sometimes given the credit for developing the first colloid mill. Von Weimarn, the Russian colloid chemist, prophesied in 1911 that he believed it was possible to make so-called colloidal dispersions by mechanical grinding or shearing, and that the important factor was to have present some stabilizer to protect the particles after dispersion. Apparently Plauson was the first one who received any great amount of publicity on such a machine to carry out these ideas, and was the one who first attempted to commercialize this work; so, therefore, is sometimes given credit for perfecting the colloid mill. His mill, however, was placed on the market the early part of 1921, and from recent records Von Weimarn apparently built his first colloid mill in 1912 to carry out his early ideas on dispersion by mechanical means.

I wish to say that since writing this paper Von Weimarn—who, I understand, is now exchange professor at Johns Hopkins—has claimed that he built his first colloid mill in 1912, but he never commercialized the art. It is, therefore, at this point proper to emphasize that it would perhaps be far better to refer to all so-called colloid mills as dispersion mills or homogenizers, since they tend to make the product more homogeneous or uniform throughout. The term "colloid mill" does not seem to express this type of machine.

In other words, the "colloid mill" is a misnomer. There has never been a colloid mill built. They are for fine dispersion and deflocculation, but they will not break down to the so-called colloidal zone; which, as you know, on the outside is about two-tenths of a micron or 200 millimicrons where you strike the zone of transparency, where the light waves are greater apart than the particle described. From there down to the molecular is what we classify as the true colloidal zone. There has never been a colloid mill built that would go down to that degree of dispersion in the disintegrating or dispersion of solid particles.

While the disintegration of solids is claimed by col-



Rough Surface Type of Colloid Mill.

loid mill manufacturers, nevertheless after a great number of experiments on a great variety of products it is my opinion that the so-called colloid mills do not actually grind—what they really do is deflocculate; and with a great number of substances this is all that is necessary, for when originally formed they were in a finely divided state, and after precipitation, or through packing in various containers, they have grouped together. In such instances the colloid mill performs a valuable service, for it will deflocculate these products in the presence of some liquid and put them back into the original fine dispersion in which they existed when they were first made. As an illustration of this point, we might take zinc oxide, which when first made is in a very finely divided state, practically colloidal, but in packing becomes grouped into larger size particles; hence, this product when deflocculated in the colloid mill in the presence of oil will go back to its original condition, the vehicle surrounding the deflocculated particles; in other words, after deflocculation they are wetted completely and remain in this finely divided state.

About ten years ago inventors seem to have busied themselves with the question of dispersing solid hydrocarbons in oil to make liquid fuels; and while frequent references may be found in patent specifications of the time to "high-speed mills," details of such machines seem lacking, although one optimistic colloidal fuel inventor desired to use a machine having a linear speed of 1,000 meters per second (200,000 feet per minute).

A few words as to the distinctive methods of obtaining the hydraulic shear forces may be of interest. In the Plauson machine it is generally understood that a combination of shearing stresses and impact forces effect the disintegrations, the revolving blades leaving and re-entering the space between adjacent fixed blades with such rapidity as to impart sufficient shock to the liquid in the thin film to disrupt and disperse the suspended matter.

Mills which depend wholly upon the shearing of a liquid film, adhering with great tenacity to the relatively fast-moving confining surfaces, may be divided into two distinctive classes: (1) Those in which the liquid is propelled through the gap by the centrifugal forces acting upon the material forming the film. They include machines having the working surfaces in the form of discs or flattish truncated cones, diverging from the ingress end. (2) Those in which the surfaces confining the film are so shaped that the film does not tend to evacuate the space by its own inertia, or in which it actually tries to work back to the feed space. Both modifications of the second class are incorporated in the Hurrell homogenizer.

The dispersion is due to hydraulic forces, the film of liquid being sheared under pressure like a solid, the particles in the line of shear becoming dispersed.

The film gap is cylindrical, or nearly so; in this way the linear speed is a constant quantity at any speed of rotation, differing in this respect from mills having, as working surfaces, discs or shallow cones.

The dispersion mill is adapted for the economical dispersion of solids, plastics or liquid masses into particles whose dimensions, as a rule, are one micron in diameter. Solids may be reduced to subdivisions that pass through filter paper. The dispersion occurs within the liquid medium, so the disruptive action is caused without contact of the surfaces of the rotor; that is, the action upon the surfaces of the rotor and stator is practically nil, but one should never use a finer clearance or higher speed than is required to do the work.

Solids should first have a preliminary grinding so they will at least pass an 80-mesh screen, unless they are of a very soft nature—e. g., like paper pulp—when this is not necessary.

General Uses for Disintegrating Mills

As an example of some of the many uses to which a disintegrating mill of proper design may be put in commercial operations, the following are typical:

(a) Emulsification of vegetable, animal and mineral oils, resins, waxes, etc.

(b) Manufacture of water paints.

(c) Incorporation of pigments in the more fluid enamels and paints.

(d) Preparation of reconstituted milk from milk powder and sweet butter.

(e) Extraction of oils, fats, resins, juices, etc., from vegetable or animal tissues.

(f) Extraction of fibrous materials.

(g) Purification of certain organic chemicals, liquid and solid.

(h) Intimate mixing of the ingredients of meat extracts and the reduction of size of particles; increasing the solubility of some and making finer suspensions of the insoluble ones.

(i) Intimate mixing of creams, sauces and other foodstuffs.

(j) Dispersion of solids, such as mica, oxides, barytes, calcined bone, china clay, pigments, pitch, coal, dyes, and a vast number of other products, is claimed.

While the above is more or less of a general list, it might be well at this time to deal with some specific case. Take, for example, the paint industry. An accurate knowledge of the percentage distribution of the various sizes of particles of colloidal material is one of the fundamental requirements in the control and

improvement of paints, dyestuffs, rubber, etc. If we study the effect of varying the size of particles of the pigment on its properties, we discover at once that obscuring or hiding power, oil absorption, capacity, permeability, consistency and the rate of disintegration of the paint film by sunlight are altered. While the degree of subdivision is not the only factor, it is a contributing one. Of the methods used in the determination of particle size, that of studying the system and obtaining the distribution relation by the application of Stokes' law of sedimentation is about the most satisfactory. Sedimentation by gravity, however, is time-consuming, so by using centrifugal force we may determine the distribution more conveniently.

Again, as a result of increase of dispersion and surface area in the dispersoid, chemical reactions are speeded up and in a large number of cases become almost instantaneous. Very often impurities may be removed from oils by emulsification, followed by the breaking of the emulsion when the impurities remain in the water phase with the emulsifying agents. An example of this is the production of carbolic and cresylic acids from tar oils, the carbolates separating upon the breaking of the emulsions. Other specific uses are:

Dispersion of Fibers.—The preparation of paper pulp and fiber for roofing felts and paper stock. The recovery of pulp from old newspapers. (In the latter process the newspaper-magazine stock is disintegrated and de-inked in one operation by addition of proper solvents to the water medium.)

Selective Separations.—The application of selective dispersion for purification is important for removal of impurities in graphite, clays, etc.

The importance of the colloid mill is of far more consequence in some cases in connection with other equipment. Take, for example, the treatment of carbon inks for typewriter carbon paper. By first using the colloid mill for passing the pigment in conjunction with the molten waxes, the colloid mill gives a very fine dispersion, but if there are some very hard particles of carbon some of these will not be completely dispersed; that is, when spread upon a glass you can note a few larger grained particles, but by running this from the colloid mill direct into a ball or roller mill a great deal of time can be saved in the final finishing up of the product, for when it enters such a mill it will be, say, 98 per cent dispersed. Hence, with these two equipments in conjunction with each other, in this case a great amount of time and power can be saved.

Lacquers and Pigments in the Colloid Mill

In the case of lacquers, which have created considerable interest in the past few years, the so-called colloid mill cannot be expected to produce a product as finely dispersed as sixty to seventy hours of continuous grinding in a pebble mill; for the rate of treatment, through a colloid mill, of this product would be figured on a capacity of from 250 to 300 gallons per hour, but by passing through the colloid mill and then treating in the pebble or ball mill this time can be reduced to a few hours. A more recent development in this line is to disperse the pigment in the presence of the lacquer solvents, omitting the nitro-cellulose. When this product is discharged from the mill, there will be an occasional large particle when spread as a film on a smooth surface; we might say, for argument's sake, that it is 98 per cent dispersed. Now, to make an ideal product, this dispersed pigment in the solvent can then have the nitro-cellulose incorporated therein, and after complete blending can be passed through a clarifier, regulating the speed so as to remove only the larger particles of pigment. As the percentage of this will be very small after treatment through the colloid mill, the bowl will not be filled for considerable time; and with the speed regulated so as to only throw out the larger particles, it makes almost a continuous process for the producing of a perfect lacquer, thus eliminating sixty or seventy hours of grinding on batches, with, of course, considerable saving and increased production.

Another interesting application of the colloid mill, and one that may interest color men, is the treatment of pigment in conjunction with a lacquer solvent, then incorporating nitro-cellulose direct. This gives sufficient dispersion of the pigment for coating on leather, the particular size of the pigment being small enough to penetrate the pores of the leather. Coatings of this have been made where they were permanent, and when put upon thin leather could be rolled without cracking and gave a very high covering power.

Dispersion of Coke in Fuel Oil

In the case of paints, the so-called colloid mill is operating quite successfully on the dispersion and mixing of outside whites and flat whites, also for the fine dispersion of lithopone, which, of course, is merely a deflocculation of the precipitate formed in the manufacture of this product.

In other words, the colloid mill will give you the finer dispersion after precipitation; it is really deflocculation.

We have also been able to get satisfactory tests on the dispersion of coke in fuel oil after the cracking process, and have gotten this in sufficiently finely divided state so that it would not clog the spray nozzles when used under the boiler. The main difficulty encountered in this case is to get machines of sufficient capacity to handle fuel oil

in tank car lots. At the present time the colloid mills seem to have a maximum output of about 500 to 600 gallons per hour. While attempts have been made to build oversize colloid mills with many times larger capacity, there have been mechanical difficulties encountered. At the present time we are working on a type of machine for this purpose, and the tests so far go to indicate that the machine will carry this heavy duty work. It must be remembered that in the colloid mills they all operate at high speed, most of them at 3,600 r.p.m., directly connected by use of a flexible coupling. Others operate at even a higher rate. Therefore there are difficulties in the way of operating 365 days a year continuously without shut down. Where these mills are operating six to eight hours a day, with the improvements recently made, we do not have a great deal of trouble, but it is quite obvious that this is much easier on the machine than operating over three shifts throughout the year where in one year the equivalent in machine life would equal a great number of years if operating a reasonable time each day.

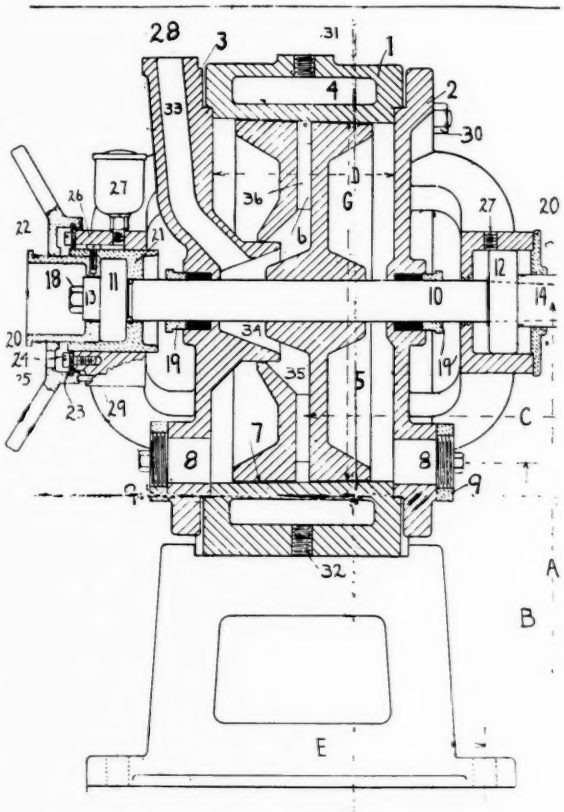
The colloid mill also has valuable applications in connection with spray drying or the drying of products in a finely divided state by dispersion in air. By first dispersing through the colloid mill in the presence of some liquid so as to get the hydraulic shearing action, this product can then be dried in such finely divided state by the use of spray dryers. Hence, this opens up a new application, where it is desirable to have the product in a dry state. Of course, in such instances there should be a proper protective colloid so as to avoid flocculation. I have observed such products in a dry state where the division was so fine that they poured like a liquid. While this work has to be conducted strictly in a highly technical manner, taking into consideration the various basic principles of colloidal dispersion, yet it is practical to produce such products commercially.

Other Applications

There is also another application besides the general question of making emulsions. By dispersing of oil in the emulsified state it is possible by passing an electric current through it to have the oil globules deposited on the positive pole or anode, for all oil in water type emulsions carry negative charges, hence, will migrate to the positive pole. A very interesting patented process is the making of an emulsion of blown oils or asphalts, then plating them out on to a surface that you wish to have a Japan finish. After plating out on this surface, it, of course, must be baked. The advantage of this electrical method is that it does not make any great difference as to the current density. The emulsion can be plated out with a current of 10 volts or 110 volts, and the question of current density, such as in copper plating, does not have to be considered. Other interesting applications are the fine dispersion of pigments or colors used in rubber fillers, where the pigment can be dispersed in a liquid and then incorporated into the rubber compound and in making of asphalt emulsions for waterproofing of concrete and in tunnel construction, etc.

Dispersion of Vat Dyes

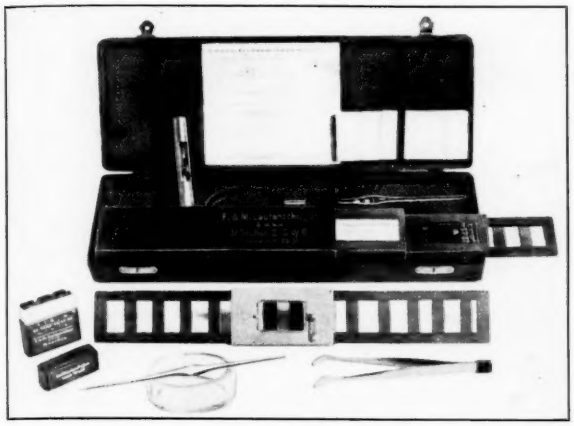
Perhaps one of the most interesting applications to color men is that of the dispersion of vat dyes. We have been unusually successful in this work and have taken the process from a laboratory scale into direct commercial production in quite a few instances. By use of the colloid mill, we have been able to make dispersion of vat dyes in water, eliminating all coarse or gritty material so that the dye would not settle nor would it scratch the rollers when applied thereon. Also in the printing on cloth, it does away with any little particles which might cause blots or blemishes. In connection with this work we have had to make quite a study of stabilizing agents,



Cross Section Through a Smooth Surface Type of Colloid Mill.

so that after the vat dye is properly dispersed in the water in this finely divided state so as to remain as a suspension, flucculation did not follow and we got the maximum of covering power.

While we have perfected a great number of such dispersions which are now in commercial application, it was



Set for Hydrogen-Ion (pH) Control

found that we could not use a general emulsifying agent to cover all cases, in some instances using one product and in others a different type of dispersing agent. Also in solving these problems there has been some difficulty in getting the proper type of dispersing agent which would not affect the covering power of the vat dye, for in some instances where perfect dispersion was accomplished, it was found that the covering power had diminished. Hence, this required a study of proper emulsifying agents to use with various grades of vat dyes for such dispersion. Hence, it is readily appreciated that the mere purchase of a colloid mill is not all that is required in this case; it is necessary to know what type of emulsifying agent to use so as to get the ideal conditions for dispersion of the vat dyes, and apparently from reports tests in a number of instances have proved very successful in commercial operation.

It is very difficult to determine the particle sizes after dispersion through the colloid mill. While these can be measured in some instances under the microscope, yet we know that the particle sizes vary over quite a range. In the case of dispersions, we have found that it is not advisable to depend too much on Stokes' law of sedimentation. This is all right in the case of perfect spheres, but in the dispersions of solid materials the various dispersed particles are of various shapes, hence do not settle, according to Stokes' law. However, relative comparisons can be made in this way. As an illustration, particles 1 micron in size, in one instance, took one hundred hours to settle through a distance of 15 centimeters at a temperature of 20 deg. Cent.; particles of 6 microns took a period of ten hours to settle through a distance of 115 centimeters at 20 deg. Cent. This was a dispersion of graphite in water, and it would not necessarily imply that particles of the same diameter in the case of other materials would have the same settling rate, as they might be of an entirely different shape. Hence, Stokes' law of sedimentation is only for comparative purposes in the case of dispersions of such materials, and may be as much as 40 per cent off, and the nearer we approach to a perfect sphere, the more we comply with the law. For instance, in the case of an emulsion where the particles are believed to be spherical, Stokes' law undoubtedly applies.

Importance of pH Control in Dispersion

Before closing, I wish to emphasize the importance of hydrogen-ion control on all dispersions, emulsions or otherwise, for in each instance the particles take on an electrical charge. As an illustration, in the case of an emulsion of the oil in water type, the oil particles have the negative charge. Hence, if the hydrogen-ion concentration is increased too much in the liquid in which the oil is dispersed, this, of course, has a tendency to neutralize the charges on the oil particles and the emulsion would not be stable. This applies also in the case of dispersion of solids. Hence, in doing such work it is most essential that we know the hydrogen-ion concentration at all times so as to correct for this according to the charge on the particles. There was a great deal of difficulty in obtaining a simple method of determining the hydrogen-ion concentration which would be practical for field work as well as in the laboratory, and a method in which we could deal with turbid solutions, for in practically all cases our solutions are turbid.

We have at last procured a very simple set for this purpose in which turbidity does not enter, and where an accurate determination can be made within two minutes' time, does not require elaborate apparatus; in fact, the entire set can be carried in a small case, and the accuracy is sufficient for all practical purposes. By the use of this simple equipment, which can be operated even by a layman, it is possible to put hydrogen-ion control into the various processes where adsorption and other problems of this sort, as well as the work in emulsions, was more readily controlled, and in an exact and precise manner. While hydrogen-ion control is not the only factor which enters into the control, it is a very important one and is becoming more so each day.

. . . At the conclusion of his prepared paper Mr. Travis showed lantern slides. . . . (Applause.)

Discussion on Mechanical Dispersion

President Killheffer—Mr. Verity, here is your opportunity. Don't you wish to use it?

Benjamin Verity—I have no need. (Laughter.)

President Killheffer—Are there any comments or questions in regard to this paper? Have you any, Mr. Christison?

Hugh Christison—I should like to ask why they use the 8.2—is that it?

Mr. Travis—Eight point two is our usual point for emulsions of the oil in water type, for the reason that all oil in water types of emulsions (I won't say all, but 99 per cent of them) have absorbed hydroxyl-ions on the oil globules and they are on the alkaline side. You can prove that by cataphoresis. If you will pass a current from a battery through an emulsion you will find invariably that the dispersed particles will migrate to the anode or positive pole, showing they are negative charges.

Recently I found one emulsion which I rather suspected might be on the positive side, although that has not been proven. It just came up in the laboratory a day or so ago. But in my experience to date I have not found any typical emulsions of the oil in water type that did not carry negative charges. Hence, by keeping it slightly on the alkaline side, with a little more absorption of the hydroxyl-ions, it promotes stability. If you didn't keep it on the alkaline side, the hydrogen-ion concentration would neutralize your particles, and you would hit what we call the isoelectric point, which is the point of least stability. And when we are making a stable emulsion, that is what we try to avoid, so we try to keep it about 8, just slightly over the neutral point on the alkaline side, in the case of emulsions.

Mr. Christison—What would happen if you made more alkaline, about 10 to 11?

Mr. Travis—That is all right for some types of emulsions. In other cases, it causes us difficulty. I have in mind at the present time an asphalt emulsion. In this case we found that if we went too high on the alkaline side we also ran into the question of electrolytes. You see, electrolytes are also the enemy of emulsions. We don't want electrolytes there if we can avoid them. If you take sodium hydroxide, for instance, your hydroxyl radical is being absorbed on the outside of your micellae and you are promoting stability. But if you go up to 12, you are getting quite strongly alkaline. Your sodium radical is cutting some factor at that point. Just what causes that, I don't believe anyone is in a position to say, but we know, as a matter of practice, that in the making of emulsions it is very poor practice, as a general rule, to go much above 8 or 8.5. You should go just slightly over the neutral point.

Mr. Christison—If that is the case, then it looks as though that might be the desirable point to make soap solutions, in laundering or in washing.

Mr. Travis—When you come to the question of laundering and washing, you are hitting very closely to a lot of problems that we have in emulsification. As a matter of fact, the problems in emulsification, and dispersion of solids, and in the dispersion of solids into air or aerosols, are all related. There is a connection all the way through in any fine dispersion, whether it be solids, or liquids, and I am pointing that out in a book that I am now writing on that subject, and showing the relations all the way through from the solid to the liquid state of matter.

We must go by definite physical laws. We cannot break those in our applications.

There are a lot of those questions in laundry work. There is no doubt about that. And in removing of dirt, and so forth, you are doing a certain amount of work that we do in our dispersion, except that you are trying to disperse the dirt, and as one gentleman who spoke before me said, he had to use the soap as an emulsifying agent. His soap is forming a protective colloid about the particles, and he is really making a dispersion, just the same as we are in a so-called colloid mill. It is mechanical dispersion that is removing your dirt.

G. A. Moran—You can make, say, a 50 per cent emulsion of oil in water fairly readily?

Mr. Travis—That depends upon the oil. A lot depends upon the specific gravity of the oil, whether it is an animal oil or a vegetable oil, as to what formula we can use. We cannot use any general formula for emulsion work. We have at the present time about 250 different types of emulsifying agents. We find in some instances that they work to perfection with certain types of oils, and with others they are failures.

We can make emulsions of oil in water up to 70 and 75 per cent. With other types of oil we can only go up to 40, and with still other types of oil we can only go up to about 20. It depends entirely upon the oil as to how far we can carry those emulsifications.

Mr. Moran—How would you produce the reverse effect, an emulsion of water in oil?

Mr. Travis—The reverse type of emulsion?

Mr. Moran—Yes.

Mr. Travis—The common answer to that is that monovalent soaps, such as we will illustrate with potassium or sodium oleate, promote the oil in water type of emulsion; bi- and tri-valent soaps (for instance, if you took calcium oleate or aluminum oleate) would promote the other type of emulsion.

The general rule on that, although it does not always apply, is that whichever phase the emulsifying agent is soluble in, that is the outside phase, and the one that it is insoluble in is in the disperse phase.

In order to reverse an emulsion and make that type, illustrating with calcium oleate, we have to have freshly precipitated calcium oleate; it is heated up in the oil phase, and then the water is added under proper conditions, and in that case it reverses.

Bancroft in his book, I believe, makes the statement that you must always have bi- and tri-valent elements. We have run into recent applications in drying for citrus fruits, in spraying compounds, where we reversed our emulsions, after we got to a definite concentration of oil. This particular problem came up about two weeks ago. We made the oil-in-water type of emulsion until we got up to about 82 or 83 per cent. When we went beyond that, it reversed and we got the water-in-oil type, with the same emulsifying agents.

So that that general rule does not hold in every case. But in a great number of cases it does hold. The rule is that bi- and tri-valent elements make the water-in-oil type and the monovalent type soaps make the oil-in-water type. That is the general rule on emulsification.

Hugh Christison—I should like to asked why you used that method of determining the pH—that is, the method of dipping a paper into the solution—rather than using an indicator.

Mr. Travis—In emulsion work and colloidal dispersions we have in every instance a case of turbidity to contend with. If the solutions were perfectly clear, we could use the regular colorometric method of matching up with clear color standards, but in these cases we have turbidity to deal with. We can't filter it out, because it is fine'y dispersed; it goes right through the filter paper. We must have a method, for turbid solutions, of registering direct, so we have this method which I have brought from Germany of exposing the films. It is like developing a photographic plate.

We have these little indicator strips, which are put into the bath, and the ions penetrate through, registering under the protecting film. Then, when it comes out, the beauty of it is we can wash the outer coating with filtered water or wipe it off—it doesn't make any difference. We have set the color inside. Then we match those on the slides which read pH direct, and it is very successful in most instances.

There are a few cases where that set does not work 100 per cent, but there are such cases with every set. Take the electrical method, with potentiometer readings, when you are liberating hydrogen. If there is any substance there subject to reduction, you are going to be 'way off on your reading also.

So that every method of determining pH has some drawback, but for all-round work and for simple work this set is about the best we have seen, and the one we are using ourselves, for pH work.

You undoubtedly know that if you said to a foreman in a plant, "I want you to keep a definite pH control on this batch," he would throw up his hands and quit. He would want to know what pH control was; and as soon as he heard a little of the theory of pH control he would say, "I have been doing it the other way for twenty years. I guess I will keep on." But you can go to that man, take a definite color standard, and say, "Now, John, I want you to keep the color within this and this section," and give him only one selection of strips. "If it goes any further over this way, or this way, I want to know about it." If he complies with that request, he is practising pH control and he doesn't know it.

We had that come up in May, on seaweed dispersion, where I was doing some consulting work. They were opposed to any theoretical stuff. The minute I saw they had a problem in adsorption, it was necessary to have some kind of contact, because the chemical action that they were having there was a matter of contact time, and the hydrogen-ion concentration was the factor. They didn't care whether they left the product in contact two hours or ten hours, or if the temperature was 90 or 60 degrees, which made a difference in chemical activity. It was necessary to put them on pH control so as to get uniform treatment of their product and produce the same product each day; in other words, to standardize. In order to do that I used this pH control method; and they don't know to-day that they are on pH control, but their product is coming out uniform.

I believe that pH control is one of the coming things for control in manufacture of batches where it can be used; that is, within the scale limit.

Mr. Christison—Does this method work well with clear solutions?

Mr. Travis—It works all right, as far as I can see. In my experience, it has worked satisfactorily, with the exception of a few solutions. If you have a great amount of gelatin present in your solution, it seems to interfere. In that case, instead of exposing for two minutes, we find we have to expose for ten minutes. It is probably the blocking. You are probably familiar with the Donnan method of equilibrium. We are probably blocking the ions from entering through and registering on the color reaction. But after about ten minutes' exposure we get it. However, I have found that the set does not work in the presence of ammonia. Ammonium salts seem to interfere somewhat with the method. That is probably due to the color standard. But in general use it has been quite successful.

Mr. Christison—Is that set on sale now in the laboratory supply houses?

Mr. Travis—I am sorry to say that we have the control of that. That is rather an embarrassing question. (Laughter.)

Mr. Christison—Do you sell it?

Mr. Travis—I shall be very glad to talk to you about it some time. (Laughter.)

President Killheffer—Are there any more customers? (Laughter.) Does someone else want to ask questions on this very interesting paper?

W. F. Deady—I should like to ask if you can use that in connection with vat color dyeing?

Mr. Travis—There are a lot of other things in connection with vat colors. Of course, my work with vat colors has all been in their dispersion with the so-called colloid mill giving the proper dispersion of vatty dyes, on which the secret is not the colloid mill. The colloid mill, you might say, is a necessary evil, even though we handle it. You must have something to split up. The colloid mill will split the product up for you, but after it is split up not all the mills or anything else will help you if you haven't got your conditions right to avoid the future flocculation. Therefore, the secret there has been the working out of the emulsifying agents or stabilizers in conjunction with the colloid mill, and working the two together on proper dispersion. In that way, we have been able to disperse vat dyes with practically no sign of grit into a smooth product.

We have not gone into the applications beyond the point of the dispersion. Our problem has been entirely the proper dispersion of them and putting them into a fine state so that they would not scratch the rollers.

President Killheffer—Are there any further questions?

Mr. Deady—I should like to ask, with regard to that hydrogen-ion indicator you mentioned, whether that works in a reducing solution like in a colored vat?

Mr. Travis—I wouldn't want to say definitely, because I haven't tried it in that particular work. We have been confining ourselves to our own use, entirely to control of emulsions, and in the dispersion of solids. We have had to study that condition. You see, on a dispersion of solids, the first thing we do is to find out which way it takes the electrical charge, and if it is a positive, we get our point where it is the least stable, and in conjunction with the centrifuge, help throw it out. We determine, approximately, the isoelectric point, and bring it back. After we have determined which type of charge we have, then we use the set to add a little more of the hydrogen-ion, if it is on the plus side, or a little of the hydroxyl-ion if it is on the negative side to help the stability, but we keep it within pretty narrow limits. With emulsification, we work with around 8 or 8.5, and with the positives we work around 6. Six is the minimum we go to. It is not necessary to go beyond that, because stability of the absorption of the ions, which we believe is what occurs to cause the difference in potential on the dispersed particles (that is, it is an absorption of the ions on the surface of that type, either positive or negative) is what makes it migrate. If they are just over the line, a slight increase in potential difference helps the stability, because then when they come near each other they repel, like charges, and you get a condition there of stability. Then you have to come around and save the day, to avoid flocculation, with your protective colloids or stabilizers. But you must be guided by pH control.

Before we were using pH control in our work, we had more or less of a hit-or-miss method. In this work, you have to get down to the point where you can get something accurate and duplicate your results, and if you have different hydrogen-ion concentrations each time, you are going to have a great deal of difficulty in your work; you are going to have variations. We try to cut out the variables, and hydrogen-ion while not the only thing is a very important factor in standardizing.

Dr. E. M. Shelton—I can help a little on the question that was asked you with regard to the reduction of vats, only from one angle. That is, the pH with which the vat color is reduced is important, and I think usually that pH has to be at a value higher than this type of device measures. I was in communication with you in connection with using it at a pH value of 10, or above, and I understand the present range is only up to 9½. I think a good deal of vat dyeing calls for a reduction of above 10.

I think that helps answer the question. I think, though, for your description, your instrument might be applicable if you could get the color range to go higher.

Mr. Travis—Of course, the unfortunate part is that we cannot dilute in that case, because I believe in most of those cases you have a buffer present, and if you have a buffer present, of course, you can keep on diluting, and your pH won't drop. The buffer will make it constant. Therefore, we cannot go above 9 or 9½, rather, and if we diluted that down 10 or 12 times we would still be able to get the same reading, due to the buffer action. The only case where we can dilute and bring it within that range is in the straight case of inorganic chemicals, or where we know that there is not a buffer present.

President Killheffer—Unless there are some other rather important questions, I think we will have to draw what is admittedly an interesting discussion to a close. (Applause.)

I want to thank you all for your very close attention through the session this afternoon, which has enabled us to get through with our program, even though a bit late.

. . . The meeting adjourned at 5.30.

[NOTE.—*This concludes the report of the Seventh Annual Meeting.*]

Perspiration

With Special Reference to Direct Colors on Cotton Piece Goods

By Dr. W. M. Scott
National Aniline & Chemical Company

THE fastness of dyestuffs to perspiration has long been a subject of considerable interest to dyestuff manufacturers and to the textile users of dyes. In spite of its importance, there has been comparatively little published about perspiration, due chiefly to the difficulty of obtaining sufficient quantities of material for a comprehensive study. It is necessary, however, to study carefully the few facts which are known, in order to devise reliable tests which will indicate the fastness of dyestuffs to perspiration.

Some years ago the research committee of the American Association of Textile Chemists and Colorists appointed a sub-committee on perspiration to investigate all the available information and recommend suitable tests for fastness. Reports of their progress have appeared from time to time in the Proceedings of the Association and form the basis of the discussion which follows in this paper.

It has been found that when perspiration is first excreted from the body of a normal individual, it contains on the average from 1.0 to 1.5 per cent of total solids in water solution. These total solids consist approximately of the following ingredients:

50 per cent sodium chloride
10 per cent other inorganic constituents, such as phosphates, sulphates, and chlorides of magnesium, calcium and potassium
30 per cent nitrogenous matter—chiefly urea
10 per cent organic acids—supposed to be chiefly lactic acid, with possibly a little acetic acid.

Factors Affecting Acidity

It will be seen that this perspiration would exhibit a weak acid reaction. Normally the concentration of this acid is so very small that it could conceivably affect only such extremely sensitive dyes as Congo Red or Congo Corinth. However, there are a sufficient number of persons who are either naturally abnormal in this respect or are temporarily in a diseased condition to make it necessary to take into consideration the effect of an acidity considerably greater than that which is indicated above.

It has been further noted that perspiration, upon standing, loses its acidic character and gradually assumes a comparatively strong alkaline reaction. This is usually ascribed to the fact that the urea and other nitrogenous substances decompose with the formation of ammonia and ammonium carbonate. It is quite possible that in actual practice, this decomposition very often does not take place, but nevertheless it must be taken into consideration in formulating tests for fastness to perspiration.

The sub-committee on perspiration of the A. A. T. C. C. used the above facts as a basis for further research and eventually recommended that two solutions should be used for artificially testing the fastness of dyestuffs to perspiration. These solutions are as follows:

Acid Solution

10 grams sodium chloride
1 gram lactic acid U. S. P.
1 gram monosodium ortho phosphate
Water sufficient to make a total volume of one liter.

Alkaline Solution

10 grams sodium chloride
4 grams ammonium carbonate U. S. P.
1 gram disodium ortho phosphate
Water sufficient to make a total volume of one liter.

In view of the use of large quantities of direct dyes for the dyeing of cotton piece goods which are designed for use in coat linings, and for other purposes where fastness to perspiration is an important factor, it seemed advisable to examine the entire range of National Direct dyes to determine which are the most suitable in this respect.

The National types which are named below were selected because, when dyed in the regular manner on cotton piece goods, they showed practically no change in shade or staining of white cotton in either the acid or alkaline test: Niagara Sky Blue, Niagara Sky Blue 6B, Niagara Blue R, Solantine Blue 2GL, Solantine Blue 4GL, Solantine Blue FF, Erie Catechine B, Solantine Brown R, Erie Blue Green CW, Erie Fast Orange CG, Solantine Orange G, Solantine Pink 4BL, Erie Fast Scarlet 8BA, Erie Fast Scarlet YA, Erie Violet 2B, Erie Yellow F, Erie Fast Yellow WB, Solantine Yellow 4GL.

In carrying out these tests, the patches of cotton were dyed for one-half hour at the boil in a bath containing 40 per cent of Glauber salt, and then ten minutes more in the cooling bath. The strength of the dyeings was 2 per cent for the colors and 4 per cent for the blacks. Each of the dyed patches was attached to a white cotton patch and duplicate sets were thoroughly wetted out, one in the acid and one in the alkaline test solution. They were squeezed to remove the excess solution and then dried in the air. This operation was repeated twice, making in all three saturations with the test solutions, with air drying in between each. The patches were then judged for alteration in shade and staining of the white cotton.

While admittedly the ultimate test for fastness to perspiration is found in actual wear by a number of different individuals, we believe that the formulas given in this article represent the nearest laboratory approach to the real conditions. At least we know by experience that the dyestuffs such as those listed above, which pass the laboratory test satisfactorily, give excellent satisfaction in practical use.—*Dyestuffs.*

The "New Dyes" Insert

The "Reporter" Inaugurates a Quarterly Bulletin of New Colors—Expressions from the Industry on the Prospects for This Service—Further Comment Desired from All Readers.

WITH this issue of the AMERICAN DYESTUFF REPORTER SAMPLE SWATCH QUARTERLY, the publishers are inaugurating a new feature which it is hoped may prove to be of interest and value to both producers and consumers of dyestuffs. This feature consists in the showing of dyed samples, illustrating the use of new dyestuffs which have been placed upon the market within the last three months. While lack of time prevented the participation of any considerable number of manufacturers in the initial showing, there will be found on the opposite page illustrations of four new colors which are completely described in the accompanying text pages.

It is the intention of the publishers to carry in each quarterly issue as many insert pages as may be necessary to accommodate all new dyes which their respective manufacturers may wish to display. Each page will be divided into six equal sections, accommodating one dyeing, whether on yarn or piece goods, in each section. These dyeings will be accompanied by brief descriptive matter on the insert page and by more complete descriptions in the text pages adjoining.

It is hoped in this way to create a means of bringing before the consumers, and placing on record for future reference, all new dyestuffs which are currently introduced into the American market. It is not intended that colors shown shall be necessarily entirely new developments, but they shall be new insofar as their respective manufacturers are concerned.

If this feature should come into general use by all manufacturers it would unquestionably constitute a bulletin which would be looked over carefully by all consumers and would form a permanent record of the development of the dyestuff manufacturing industry.

Obviously, the value of such a service will depend entirely upon the degree of support which it receives from dyestuff manufacturers generally. If only a few manufacturers utilize it, it will have relatively little value, but if, on the other hand, practically all new colors are illustrated in this manner it should have very real value to all elements concerned in the production or use of dyes.

The publishers will assess against the individual manufacturers who illustrate dyeings the cost of publication, which will vary in accordance with the number of samples shown throughout the year, and with the type of dyeing used. A yarn bow, for instance, will cost considerably more per insertion than a piece goods swatch.

This service will be carried throughout the four issues of 1928 as an experiment, and the question of whether or not it will be continued thereafter will depend entirely upon the volume of support accorded to it and the general interest which it arouses throughout the trade. It is hoped that all readers of the REPORTER, whether manufacturers or consumers, who have any views as to the usefulness of this service, and the desirability of its continuance, will communicate with the publishers.

Before venturing upon the inauguration of this service, form letters were sent to various representative factors in the dyestuff manufacturing industry, and we quote below two typical letters which seem to sum up the feeling in regard to this feature. One of these letters reads as follows:

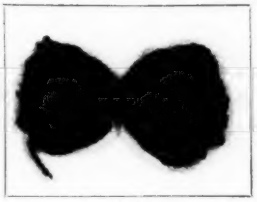
> The suggestion made in your letter of December 14th seems to have decided merits, particularly if an effort is made to have these Sample Swatch Quarterlies illustrate all the important new types introduced by responsible manufacturers. In this way the Quarterly would have not only a historical value but also become a first-class reference book in regard to the manufacture and marketing of products in the United States.
>
> Deutsche Farber Zeitung has been used very extensively for such purposes, and we always considered it very reliable and authoritative, and if we understand your suggestion, it is somewhat along the line that the Deutsche Farber Zeitung has been carrying out in Germany for a number of years.
>
> We are, therefore, keenly alive to the advantages of this work. On the other hand, we feel that if this work is to be complete, considerably more samples will have to be illustrated than is contemplated in your letter. For instance, our company may put out forty to fifty new types during the next year. Some of these types should be illustrated in one way and others in a different way. For instance, certain types will be illustrated for lakes, some for paper, and if the work is to be correct and complete, it seems to us that a particular dye will have to be very thoroughly illustrated for use in the particular fields where it finds consumption.
>
> Under these conditions the charge per sample is extremely high from an advertising point of view, although it may not be excessive for the amount of work involved in publishing. Practically all manufacturers illustrate their products directly to the trade by circulars and pamphlets, and the publication of the Quarterly will become of value only as an authoritative reference which should be of great advantage to users of dyes as well as to the manufacturers.
>
> I thought it was the spirit of your letter to open a free and frank discussion of the problem and there-

NEW DYES

Introduced commercially in the United States by their respective manufacturers within the last three months.

Newport Acid Anthraquinone Blue SE

Schultz Number (None)



Col. Index Number 1053

1%

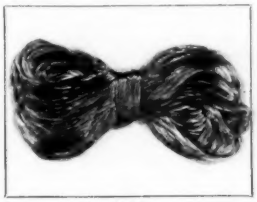
Maker: Newport Chemical Works

The distinguishing characteristics of this color are its excellent fastness to light and its resistance to water spotting. It has also good fastness to perspiration and resists dilute acids and alkalies. Cotton, rayon and silk effect threads are left unstained.

(See text for further description.)

Amidine Brilliant Red TR

Schultz Number 358



Col. Index Number 436

1%

Maker: John Campbell & Co.

This is an exceptionally brilliant direct color which has the property of leaving silk unstained. It has good fastness to rubbing, ironing, alkalies, chlorine, milling and organic acids. It discharges clearly and is consequently useful in calico printing.

(See text for further description.)

Newport Light Fast Heliotrope 2 BL

Schultz Number (None)

Col. Index Number 319

2%

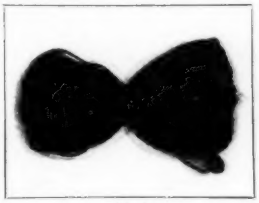
Maker: Newport Chemical Works

This product has remarkably good fastness to light, is easily soluble and very level dyeing. It dyes silk, cotton and rayon in rich shades which are readily dischargeable; hence it finds extensive use for grounds to be printed.

(See text for further description.)

Anthrene Blue RCX Paste

Schultz Number (None)



Col. Index Number (None)

10%

Maker: Newport Chemical Works

This is an entirely new vat color. Although in many respects similar to the well-known GCD brand, it is slightly redder and possesses greater fastness to chlorine. Otherwise it has the excellent general characteristics of its class.

(See text for further description.)

A New Service—An Experiment

With this issue of the AMERICAN DYESTUFF REPORTER Sample Swatch Quarterly the publishers are inaugurating a new service which it is hoped may prove interesting and useful to both consumers and manufacturers of dyestuffs.

The plan is to show sample dyeings of new dyes introduced in the United States during the three months preceding each issue—as illustrated in this case by the four dyeings shown above. Brief descriptions will accompany each sample and full information will be given in the text pages adjoining. The cost of this service will be assessed against the manufacturers whose colors are illustrated.

A complete description of what it is hoped to accomplish by this service, together with comments from representative factors in the industry, will be found in text pages adjacent hereto.

This feature will be conducted experimentally throughout 1928. Obviously, in order to be of real value it must be well supported. The measure of support accorded, and the general interest shown throughout the trade, will determine whether or not it will be continued after the close of the present year.

fore I have given you my ideas. So far as our company is concerned, we will not be in a position during 1928 to take advantage of this advertising as our budget has been made up and passed by the directors, and we cannot add such a substantial item as would be involved in this publication. I, however, want to state that I think your idea is worthy of the most earnest consideration for the future.

Another letter reads, in part:

The scheme suggested in your letter of December 3th has a good deal of merit and we would be inclined to make use of it.

There is one thing, of course, that would have to be watched and that is that in a scheme of this kind you may get all kinds of colors sent to appear in any particular issue and it is easily possible that any particular six might be of such a character that it would be utterly impossible to show them on the same page right next to each other, because one or two among them might make a visual appraisement of the others practically out of the question. Of course, this is something that might not arise once out of a dozen times, and then again it might arise the very first time. I would suggest, therefore, that in such case a proof sheet might be sent to the firms contributing colors in any particular issue for their approval of the arrangement. By this I do not mean a proof of the printing, but simply a proof of the arrangement of the dyeings. In this way, if there was a clash, some colors might be withdrawn for a later month or substituted by others.

Descriptions of the properties of the four colors illustrated in this issue follow:

The Pattern Sheet

NEWPORT ACID ANTHRAQUINONE BLUE SE

Schultz No. (None); Colour Index No. 1053. Manufactured by Newport Chemical Works.

The prototype of this product is known as Alizarine Saphirol SE which has always been a great favorite among wool dyers because of its extremely level dyeing qualities and its exceptionally good penetrating ability. The distinguishing characteristics of the color, however, are its excellent fastness to light—good even in the palest of shades—and the resistance that it has to spotting. Water—even salt water—will not leave marks, and this quality makes it invaluable for carpets and rugs, particularly those destined for seaside resorts and steamships. Likewise, it is resistant to dilute acids and alkalies, and the fastness to perspiration makes it desirable for dress goods and suitings. For use in these latter purposes, it should also be noted that effect threads of cotton, rayon and even silk are left unstained.

From the above, it can be easily seen why it is that the color finds extensive use in the manufacture of mohair plushes and other upholstery fabrics. Its good fastness to weather and its penetrating qualities make it highly desirable for dyeing hat felts.

Although primarily an "acid color" it can be readily dyed with the use of mordants; the shade obtained is greener and duller but the fastness qualities are improved.

AMIDINE BRILLIANT RED TR

Schultz No. 358; Colour Index No. 436. Manufactured by John Campbell & Co.

This is an exceptionally brilliant direct color and is used extensively to produce a medium shade of bluish pink on cotton piece goods, hosiery and cotton-back satin. When dyed on cotton-back satin the silk face is left unstained in the presence of soap in the dye bath. It has good fastness to rubbing, ironing, alkali, chlorine, milling and organic acids. It is moderately fast to light, washing and inorganic acids. It discharges clearly and on account of this quality, coupled with its brilliancy, is very useful in calico printing.

NEWPORT LIGHT FAST HELIOTROPE 2BL

Schultz No. (None); Colour Index No. 319. Manufactured by Newport Chemical Works.

This product is identical in character and properties with the old Penzo Fast Heliotrope BL. It is, however, an improvement over that product in that it has greater purity and brilliance, but all the notable fastness properties are retained. The shade of the new American product is also a trifle bluer than the German prototype.

The chief characteristic of this product has always been its remarkably good fastness to light. Its easy solubility and level dyeing properties have also added to its popularity; they make it useful for dyeing combination shades. Silk, as well as cotton and rayon, is dyed rich pure shades and these are readily dischargeable; so the product finds extensive use for grounds to be printed. It is also a very good color for dyeing tin-weighted silks.

ANTHRENE BLUE RCX

Schultz No. (None); Colour Index No. (None). Manufactured by Newport Chemical Works.

This color is new; previously there never has been a product exactly like it, though in many respects it is similar to the well-known GCD brand. It is, however, slightly redder than that product and surpasses it in fastness to chlorine. In fact, it was primarily to obtain this fastness that the color was developed. In its resistance to bleaching it is comparable to the BCS brand and therefore of value for shirtings, percales, ginghams and all other goods which are to be bleached in the piece. As it is absolutely unaffected by metals, it may be used in any type of machine and for cotton in any stage of manufacture. In all other ways, it has the same excellent characteristics of the class to which it belongs, namely, great resistance to the action of light and weather and superior

fastness to washing, even though done in a boiling soap. Its fastness is also superior to crocking, hot pressing, acids and alkalies, perspiration, bleeding and steaming.

It is important that a temperature not in excess of 120 deg. Fahr. be used for the reduction and the dyeing. It is a very good color for dyeing rayon but is not particularly recommended for silk.

RECENT LITERATURE

Research in New England

Better Business Through Research in New England Industry. Introduction and Summary of Findings of Survey Made for the New England Council. 30 pages.

At least one group of business men in one section of these United States would have the world know what research is doing for their industry. That group is the very enterprising New England Council and through its Research Committee it has issued the results of a valuable survey recently completed by the Metropolitan Life Insurance Company. We quote from a foreword to the book by an official of the insurance company, James L. Madden:

> The old, intuitive method of determining business policies is gradually being replaced by fact finding because modern business has become too complicated for guess-work or for rule-of-thumb methods. Progressive business has lifted a page from the experience of science and there is a growing realization that the formulation of successful management policies must be based on the accurate and thorough collection, organization and interpretation of facts. It is not surprising, therefore, to find a definite trend among progressive employers to supplant opinion, as a basis for business judgment, with fact-finding. As a result, the executive has essential facts which deal with the structure of his business, as well as information on external economic data, which, directly or indirectly, may affect his operations.

This survey of business research in New England followed three lines of investigation: Research applied to sales; production research, and employment stabilization. It was apparent to those in touch with conditions that some New England enterprises have been using research to help stabilize and broaden their business. But the actual extent to which research was thus utilized, in what manner, with what results, were questions this survey undertook to answer. Specialists visited 334 companies and made factual reports of the effective use of research.

The findings are trenchantly summed up in the brochure under review. Sales research was studied as an aid to advertising; in the sphere of sales management; applied to style and design; in sales analysis; in collection of economic data; and in development of foreign trade. Production research was studied in its application to development of old lines and in the introduction of new lines; to standardization and simplification; to improvements in manufacture and control.

Detailed reports of the findings in each of these lines of study will soon be published. Meanwhile a copy of this informative summary should be obtained from the New England Council by every business and technical man in the textile industry interested in the practical applications of modern research methods.

A Year in the Department of Commerce

Fifteenth Annual Report of the Secretary of Commerce for the Fiscal Year Ended June 30, 1927. 309 pages.

This annual resume of the functions and accomplishments of Herbert Hoover's prodigiously active department contains information of interest and considerable value to virtually every manufacturer in this country and to every employee of every manufacturer who would like to learn something about the ramified activities of the Government in business.

It is a "Who's Who" not of individuals but of bureaus. The extensive interests and functions of every bureau of the department and of every division of each bureau are concisely explained. The report proper comprises a lengthy economic review of American business for the year, followed by separate reports on Foreign Trade, National Efficiency, Waste Elimination, Increase of Living Standards and Commercial Aviation. Then follow the condensed reports of all bureaus, which form the bulk of this bulky book.

Textile chemists and colorists will be especially interested in the report of the work undertaken by the various laboratories of the Bureau of Standards, wherever such work is aimed at improvement in textile processing and dyestuff application. We have in mind particularly, of course, the extensive research studies on the fastness of dyed fabrics in which the Bureau of Standards is ably co-operating with the A. A. T. C. C. But as the Bureau itself will shortly issue its annual report, discussion of this work will be withheld until that report is received.

More Government Specifications

United States Government Master Specifications for White Oil Cloth; Colored Cotton Rags Sterilized; Cotton Tablecloth; Jute Burlap; Wool Bunting; Axminster Carpets and Rugs; Wilton Carpets and Rugs; Plain Velvet Carpets; Indelible Marking Ink for Fabrics.

These master specifications have recently been issued in leaflet form by the Bureau of Standards and cover the types, material and workmanship, general and specific requirements and methods of inspection and tests, etc., for each kind of merchandise specified.

AMERICAN
DYESTUFF REPORTER
SAMPLE SWATCH QUARTERLY

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL
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A PERMANENT RECORD OF NEW DYES

OTHER than certain unpublished data compiled by the Government, no general record has been kept of new dyes developed in this country from year to year. Notices of such colors are published in the journals of the industry, it is true, and in these the products are described, but this means of recording additions to the dyestuff lists of various manufacturers has been too intangible to be of value for later reference.

It is with the thought that a more material record should be kept of all important new dyestuffs that the publishers of the REPORTER introduce in this quarterly issue a feature unique so far as American dyestuff journals are concerned. On another page will be found dyed samples, accompanied by descriptive text, of four colors that have been placed on the market in recent months. Future quarterly issues may carry more than one page of these samples. Opinions from interested readers on the usefulness of this new feature will be welcome.

A STUDY IN VIEWPOINTS

THOSE who are interested in the controversy over the responsibility for damage to fabrics in cleaning and laundering will find much that is very instructive in the papers and discussions on the subject published in this issue, in the Proceedings of the A. A. T. C. C.

It may be many months before we are treated again to such a thorough discussion of this question that has become so perplexing to the textile industry. We should be sure, however, to recognize the quality that chiefly makes these particular papers and discussions of educational value in clarifying the problem. It is not alone what was said by the representatives of the laundry and dry-cleaning trades and by the mill men that is so enlightening. We should, rather, avoid taking too literally some of the statements made, especially during the discussion; for we must consider that some persons who participate in such discussion occasionally say things at the moment that do not express accurately what they intend. In fact, hardly anyone rising to speak without notes or preparation can so word his statements that they voice exactly the idea he wishes to express.

What we are given, however, in the papers and discussions on the cleaning and laundering problem is an expression of attitudes or viewpoints. If we look beyond the words of the speakers we may see their individual attitudes, and seeing, understand some aspects of this complicated matter that were not quite clear to us before. In the papers by George H. Johnson, representing the laundry trade; by Lloyd Jackson, representing the dry-cleaners, and in the discussion from the floor that followed, in which some mill men took part, the various viewpoints of the principal groups involved in the issue are clearly expressed. The points at which they cross and conflict should be noted because those are the points that must be settled.

BRANDED FABRICS AND DAMAGE CLAIMS

ONE condition that, in the REPORTER'S opinion, affects the issue of fixing responsibility for damage to fabrics in laundering and dry-cleaning has not been sufficiently recognized. It is the growing tendency of the public to buy textile merchandise by brand and trade-mark.

The new competition in textiles will be between trade-marks rather than between prices. For the consumer is being educated to look for fabrics carrying the well-advertised brand marks with which he is familiar. Claims for color fastness are being featured in conjunction with such trade-marked fabrics, and if a guarantee is offered it means something to the shopper because it is backed by the brand name. Well-planned advertising in women's publications will eventually enable these fabrics to override the competition of lower priced, unmarked goods. The difference in cents per yard will, in time, be regarded by the consumer as a kind of insurance against damage to the fabric in washing or cleaning.

It should be understood by the public and by the cleaners and laundries, of course, that a trade-mark does not always indicate a cleanable or washable fabric. Right there lies the competition between brands. On the other hand, in not a few cases the laundry or the dry-cleaner may conceivably damage fabrics through improper cleaning methods. That question should be settled by *standardizing* washing and cleaning practice so that offending laundries or cleaners can be discovered. Progressive textile manufacturers making advertised brands will then make certain that their goods conform to those standard methods—something which should not increase the cost per yard to any appreciable degree. The sales advantage in being able to claim washability for their brands—provided the standard laundry methods are used—justifies the endeavor to make trade-marked goods that really are cleanable and washable.

A certain quantity of inferior unbranded merchandise will always be made and will always sell, and will compete in price with the reputable brands of fabrics. This class of goods will always be the most prolific source of trouble for dry-cleaners and laundries. But the mills must produce some low-grade fabrics to satisfy the demands of certain markets. Such merchandise ought to be clearly labeled "not washable"—a practice that should not reduce its retail sales, since cheap goods will always be needed for many purposes.

The laundry and dry-cleaning trades may even go so far as to issue to their patrons lists of those trade-marked fabrics that can be safely washed and cleaned. This would tend to stop at the source many of the claims for damage.

The peculiar market conditions thus created by the growing popularity of trade-marked textiles is certain to affect any solution that may be worked out for fixing the responsibility for damage claims.

A TIMELY CHEMICAL TRADE MEETING

AN acorn planted by the American chemical industry two years ago has grown into an oak which, though too young to be termed "great," has nevertheless taken upon itself great functions. The acorn was the idea of organizing a Chemical Advisory Committee, made up of the key men of the industry, to work with the Chemical Division of the Department of Commerce.

The Advisory Committee was organized, its members representing all important branches of the chemical industry, and last year a general meeting was held in Washington, attended by an encouragingly large gathering of chemical manufacturers. The Department of Commerce was host. Trade problems relating to foreign markets and movements in the European industry were discussed; the services of the Bureau of Foreign and Domestic Commerce were explained as a step toward broader, more active co-operation between the Bureau and the chemical industry.

A similar meeting has been arranged this year and will be held February 16th. The topics slated for discussion are of far greater import to the welfare of our dye and chemical industry than even those of the first meeting's program.

In the past year a number of issues vitally affecting the American dye industry have arisen and now call for some urgent action. In Europe, in England, they have been lining up their chemical trusts in a manner that, in spite of all assurances to the contrary, looks suspiciously like preparation for a trade war in which our chemical markets will be the stakes. Perhaps we like too much the role of alarmist. At any rate we are not playing that role alone. Many in the industry have expressed apprehension over the activities of European trusts. In the past few weeks there have been indications—vague, it is true, but persistent—that the German interests plan to assume control of certain companies in the United States. The film industry is specifically mentioned. The capitalization of the I. G. has been repeatedly increased. Its foreign trade has been steadily expanding.

Our dye and chemical manufacturers, in view of these conditions, should feel gratified over the prospect of gathering in Washington next month with United States trade commissioners and bureau heads who have been intensively studying conditions abroad that affect their industry. Judging merely from the subjects that will be discussed and from the character of the attendance, we would say that this meeting is well timed; that it will be a lively one; that it will be highly informative for those attending, and that it should be productive of tentative plans—truly practicable plans—for strengthening the commercial position of the industry.

The chief of the Chemical Division and the members of the Chemical Trade Advisory Committee, by their enterprise in arranging these meetings, are doing a most commendable service that deserves the entire industry's whole-hearted support.

BRITISH CHEMICAL TRUST INCREASES ITS UNITS

No Progress Made in International Agreements.

For the purpose of securing control in several smaller British companies, the board of the Imperial Chemical Industries, Ltd., or I. C. I., recently obtained from its stockholders approval to increase preference shares out of existing authorized capital. The increase is reported to be to the extent of 6,585,000 shares of one pound sterling each.

No substantial portion of this amount, it was definitely stated by the chairman, will be issued immediately; a partial issue will be made as required to purchase control of additional companies. Although mention was made in this connection of the British Alizarine and Mond Nickel Company, interest in this direction was not officially confirmed. At present the only stock issue contemplated will be for the purpose of purchasing control of the Cassel Cyanide Company and three other relatively small domestic firms, according to a dispatch from the department of commerce.

This activity of the I. C. C., it is further declared, has no connection with the international negotiations that have been pending for several months. It is even stated that there are no immediate prospects of British participation in the European cartel beyond possible agreements on certain commodities.

I. G. LOAN APPROVED

A loan of 250 million marks proposed to the stockholders of the I. G. Farbenindustrie Actiengesellschaft or German dye trust has been approved and an issue of 60 million marks of preferred stock voted. President Herr Duisberg advised that a dividend of 12 per cent can be declared.

Technical Notes from Foreign Sources

Fixing Chrome on Cotton

Fixing large amounts of chrome salts on the cotton fiber is not a simple matter, except by printing and steaming. A difference must be made, however, between the desired actions of the chromium salts—that is, whether they must act only as mordants or as coloring matters as well. Khaki and like colors are obtained with the aid of chrome salts used as dyestuffs, and in all the other uses of these chemicals they act as mordants. Special processes must be used in every individual case. For example, window curtains and shades are printed on both sides with chromium acetate; and, in fact, with the green variety. After printing and drying, the material is passed through a steaming apparatus and the color is developed after treatment in soap and soda liquor. Bright green colors characterized by great fastness to light are obtained when the material is slop-padded with green chromium acetate containing a small amount of ammonium acetate. After drying and steaming, the fabric is soaped. The color tone may be deepened by the addition of Alizarin Vindin or Chrome Green.

Mixtures of chrome alum and lead acetate are used in obtaining khaki colors. Other substances may also be used for this purpose. The requirement that the khaki shade shall be fast to citric acid is attained by mixing some iron salt with the chromium salts. Chromium sulphite is the best chromium salt to use for mordanting the so-called chrome dyestuffs, on the condition that it is obtained in proper quality and is correctly used. A very considerable precipitation of chrome oxide can be obtained on the cotton fiber when the latter is brought into contact with a mixture of a bichromate and hydrosulphite or formaldehyde hydrosulphite, and the fibers are thereafter steamed for a short time.

Another method is to use 372.5 parts of chrome alum, 70.7 parts of soda and 49.2 parts of Glauber salt. These solids are dissolved in water to make 1,000 parts by weight of solution. The goods are treated twice in this liquor and then rolled up and allowed to remain over night. After drying, the goods are sent twice through the steaming apparatus, then washed and dried.

Various methods may be used for fixing the chromium oxide on the fiber when the salt is used as a mordant. The goods may first be impregnated with a solution of this salt, 33 deg. Tw. concentration, and then treated after drying and steaming with a dilute solution of sodium carbonate for a period of ten seconds. The temperature of the solution should be 75 deg. Cent. A solution of sodium hydroxide of 20 deg. Tw. concentration at a temperature of 75 to 80 deg. Cent. may also be used for this purpose. It was found that the treatment with soda is the preferable one. Experiments have also been made in which the after-treatment was effected with the aid of sodium silicate alone as well as sodium silicate in admixture with sodium phosphate, sodium carbonate and sodium hydroxide. Other experiments have also been carried out with a mixture of chromium bisulphite and chromium acetate. The results obtained vary considerably both from the standpoint of the depth of color as well as the fastness of the dyeing, and no one treatment has been proven to be the best. (Dyer and Calico Printer, through Der Textilchemiker und Colorist, 1927, pages 129-130.)

Specially Prepared Thickeners

Austrian Patent No. 104,377 describes a process for making thickener compositions which have no decomposition effect on diazo solutions, and which, in fact, tend to promote the stability of these solutions. The customary thickeners which are used for diazo solutions and colloids and are added to the color bath or the color paste are used in the form of emulsions. These emulsions are made by mechanical treatment of the difficultly soluble gums in the presence of water at ordinary temperatures. Thus, such substances as cherry gum, gum tragacanth, Iceland moss and the like are softened in cold or lukewarm water until complete swelling takes place. The swollen mass is then mechanically worked up in the grinding mill until a perfectly homogeneous mixture is obtained.

Design Printing on Fabrics with Wax

The goods to be printed in this manner are played on a solid, smooth sheet of wax and are printed with the aid of a heated metallic stencil which carries the design. The heated liquefied wax penetrates the fabric at the printed parts. The wax sheet or film may be carried on a cylinder, and a roller which carries the design may be used in the printing process. The solid wax film may be replaced by a cloth which has been impregnated with the wax. The fabric that is printed in this fashion may be stretched over the wax sheet at a short distance from it (for example, one or two centimeters) so that after the fabric is pressed against the wax film it is immediately drawn away from it by the tension on the fabric, and thus the two do not stick together. (Austrian Patent No. 104,395.)

W. R. SMITH IN THE SOUTH FOR U. C. P.

The United Chemical Products Corporation of Jersey City, manufacturers of dyestuffs, sizings and textile specialties, announce that W. R. Smith has succeeded R. T. Grant. Mr. Smith has been associated with this concern for several years and is well known throughout the trade. His headquarters will remain at Raleigh, N. C., as at present, but he will cover the territory adjacent to Charlotte, the former headquarters of Mr. Grant.

It is understood that other salesmen will shortly be added in the Southern territory by United Chemical Products Corporation to handle the products manufactured by their Jersey City and Pluckemin, N. J., plants.

MID-WEST LAUNDRIES TO MERGE

A merger of twelve laundries and dry-cleaning establishments, two in Milwaukee, four in Chicago, three in Detroit, one in Lansing, Mich., and one in Flint, Mich., is contemplated. Several millions are involved. While the merger is now confined to a few cities in Michigan, Illinois and Wisconsin, it is expected to be enlarged later.

EATON-CLARK CELEBRATE

Moved by two very good reasons the Eaton-Clark Company, dyestuff and chemical manufacturers of Detroit, held a reception on January 7. The first reason was the formal opening of the company's new offices, located at 1490 Franklin Street. The second reason was that this new year celebrates the 90th anniversary of the business founded in 1838 by Theodore H. Eaton.

The new offices, with additional warehouse facilities, were completed and occupied last August, but for the reason above mentioned the Eaton Clark Company postponed opening them formally until this month.

J. N. McLaren is now with the sales department of the American Hard Rubber Company, 11 Mercer Street, New York City. Mr. McLaren, whose technical experience has taken him into the rayon industry, will give most of his time in his new capacity to handling hard rubber equipment for rayon manufacture and textile processing. The piping, fittings, pumps, tanks and other hard rubber products of his company find an important market in these two fields.

Directors of British Celanese Corporation, Ltd., issued statement that it is impossible to manufacture acetate, yarns, fabrics, etc., without infringing their patents. They also state that, if necessary, they can, by simple process, transform Celanese into a product similar to viscose, if sufficient future demand necessitates the change.

L. B. Fortner & Co. moved its Boston office on January 3 to 88 Broad Street, according to an announcement from Manager Alan A. Claflin. The firm's telephone number is unchanged.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i. e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

DYESTUFF SALESMAN

Wanted—An experienced high-grade dyestuff salesman with good knowledge of vats. One acquainted with Philadelphia territory preferred. Reply confidentially, giving age, experience, salary desired, etc. Address Box 438, American Dyestuff Reporter.

AGENCY WANTED

Old established firm manufacturing chemicals and chemical specialties desires to offer an agency for the exclusive handling of their products throughout the Southern textile territory. Will consider only those of established standing. Correspondence will be treated confidentially. Address Box No. 439, American Dyestuff Reporter.

CHEMIST WANTED

Wanted—Chemist who has had practical plant experience in the production of Azo colors and the intermediates required in the manufacture of Azo colors. Please state experience and salary desired. Address: Classified Box 440, American Dyestuff Reporter.

COLORISTS

Wanted—Colorists capable of matching shades. Moderate salary to start. Apply letter only, giving experience and salary desired. Address replies to American Aniline Products, Inc., 45 East Seventeenth St., New York City.

TEXTILE CHEMIST

Textile chemist wanted for technical service department of an old-established firm of manufacturing chemists making products used in bleaching, dyeing and finishing. Technical and plant experience necessary. Man between 35 and 45 years of age preferred. Must be capable of demonstrating and supervising processes of application. Real opportunity for development to man of proper qualifications and initiative. Write, stating full history, education, experience, references and initial salary. All replies held strictly in confidence. Address: Classified Box 442, American Dyestuff Reporter.